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THE SYSTEMATICS AND MORPHOLOGY OF THE NEARCTIC SPECIES OF *DIAMESA* MEIGEN, 1835 (DIPTERA: CHIRONOMIDAE)

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THE SYSTEMATICS AND MORPHOLOGY OF THE NEARCTIC SPECIES OF *DIAMESA* MEIGEN, 1835 (DIPTERA: CHIRONOMIDAE)[1]

BY

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INTRODUCTION

Adults of the genus *Diamesa* Meigen are medium sized, brown or dark gray chironomids. The larvae live in cold, well-oxygenated water of streams (Figs. 30-33), springs, glacial or snowfield meltwater streams, or, more rarely, in the shallows of arctic ponds (Thienemann, 1937b; Styczynski and Rakusa-Suszczewski, 1963). The genus is most abundant at higher elevations and latitudes — species occur far above timberline in the mountains, and one species has been found nearly as far north as land extends: Ward Hunt Island off the northern coast of Ellesmere Island. In the United States, the adults of several species emerge in the winter months and may, during a winter thaw, be rather common on the snow along streams — hence their common name of "winter midges." The

[1] A thesis submitted to the faculty of the graduate school of the University of Minnesota in partial fulfillment of the requirements for the degree of Doctor of Philosophy, March 1973. All the new species are to be credited to the senior author only.

males of many of the species have the plumose antennae and slender legs typical of the family and are active fliers (Fig. 149). In some species, however, the male antennae are non-plumose and shortened, the legs are longer, and the adults run about on rocks in streams and are much less inclined to fly. At least two such species have brachypterous forms.

While the European fauna has been quite well worked out (Pagast, 1947; Serra-Tosio, 1964; 1966; 1967a, b, c; 1968; 1969a, b; 1970a, b, c; 1971; Wuelker, 1959), the nearctic species have been very poorly known. No keys to the identification of adults have been published, and accurate determination of species has been difficult with the scattered and often inadequate descriptions. This revision treats the adult male stage of those species occurring in the Nearctic Region north of Mexico. A study of adult morphology, to serve as a foundation for the descriptions, is also presented. In all, 30 species are recognized as valid and are described. Nine of these are new, and one is a new nearctic record of a European species. Six species are regarded as new synonyms, and one name is a *nomen dubium.*

Acknowledgments

Dr. Edwin F. Cook deserves my grateful appreciation for his constant help and advice. His suggestions on literature, morphology, nomenclature, and other aspects of systematics were invaluable to this study.

Sincere appreciation is extended to D. R. Oliver (Canadian National Collection, Ottawa) for the loan of the extensive Diamesinae collection there and for suggestions and advice, to W. W. Wirth (United States National Museum, Washington) and S. S. Roback (Academy of Natural Sciences, Philadelphia) for the loan of extensive collections and type material, and to J. E. Sublette (Eastern New Mexico University, Portales) for material and advice. S. L. Tuxen (Universitetets Zoologiske Museum, Copenhagen), A. M. Hutson (British Museum (Natural History), London), and E. Taylor (Oxford University) also deserve special thanks for the loan of several type specimens.

For other loans, I wish to thank the following individuals and institutions: R. Alexander (University of Michigan), W. Barr and J. Gillespie (University of Idaho), A. Gaufin (University of Utah), G. Finni (Purdue University), W. Hanson (Utah State University), G. Kraft (Western Washington State University), R. Kramer (Utah State University), R. Narf (Wisconsin Department of Natural Resources), L. L. Pechuman and C. Valley (Cornell University), M. T. James (Washington State University), D. Ribble (University of Wyoming), B. Serra-Tosio (University of Grenoble, France), T. O. Thatcher (Colorado State University), R. Thut

(Weyerhaeuser Company, Seattle), H. K. Townes (American Entomological Institute, Ann Arbor), and D. Webb (Illinois Natural History Survey). J. Lawton (Milwaukee Public Museum) kindly searched for the types of *D. mendotae* Muttkowski for me.

For help gaining access to collect in unfamiliar and somewhat inaccessible territory, I would like to thank D. Easterbrook (Western Washington State University, Bellingham) and A. Davis (Buffalo, Wyoming).

Sincere appreciation should be given to my wife, Barbara, for her help on collecting trips and her constant encouragement. I must also thank my parents, on whose land, several winters ago, I first became intrigued with winter midges, and where I have done a good deal of collecting.

Much of the work was supported by a grant from the National Institutes of Health (Grant No. AI-07029). This assistance made the study possible and is gratefully acknowledged. The Department of Entomology, Fisheries, and Wildlife furnished support for the scanning electron microscope work and for the plates.

Scope of Study

At the start of this study, I had hoped to revise the entire subfamily Diamesinae, treating larvae, pupae, and adults, but this proved to be impractical. Furthermore, as work progressed, the need for a study of adult morphology became evident. Many chironomid descriptions, I found, were too superficial, and terminology used in descriptions was morphologically incorrect. I therefore decided to study the morphology of the adult male and attempt to correlate systematic terminology with morphological interpretations. This would then serve as a foundation for my descriptions of *Diamesa,* beside being applicable to other studies in the Chironomidae and other Diptera. This revision seeks to put the systematics of the adult males of nearctic *Diamesa* on a firm basis. No discussion of sister groups, higher classification, phylogeny, etc. is attempted; this will have to wait for a further study of the immatures of *Diamesa* and a revision of the other Diamesinae.

Historical Review

Meigen originally intended to use the name *Diamesa* for a genus of Cecidomyiidae, and a figure of a fly with this name appeared in his 1830 work (Tab. 65, Fig. 16 & 17). In a footnote in the text, however, Meigen (1830: 308) states that this genus had been described as *Lestremia* by Macquart and that the name *Diamesa* in the figure should be changed to *Lestremia,* as he did in the text of his work. This use of the name *Diamesa*

in a figure is the reason for the citation of "Diamesa Meigen 1830" in Neave (1939).

The next use of the name was in Waltl (1835). The title of the paper (translated), "New species of Diptera from the region of Munich," is followed by a subtitle, "named and described by Meigen, discovered by Dr. J. Waltl." The paper is a series of descriptions, number 3 of which is "*Diamesa.* (Novum Genus.)*," followed by a description. The asterisk after "(Novum Genus)" refers to the footnote (translated), "The species '*cinerella*' is at the same time codescribed." The same paper was repeated, with only minor changes, in Waltl (1837). This latter paper had no subtitle giving Meigen authorship of the species, although a phrase in parentheses after the author's name states "Aus dem Faunus von Gistl.," the journal in which Waltl (1835) appeared. Species number 3 in the series was given as "*Diamesa cinerella* (neue Gattung)," followed by essentially the same description as in Waltl (1835).

In his 1838 work Meigen included two species in *Diamesa,*[2] namely, *Waltlii* and *Gaedii.* No mention was made of *cinerella* or of Waltl's two papers, although Meigen does, in his "Vorrede," acknowledge the "numerous contributions" of specimens from Dr. Waltl. The description of *Waltlii* is, however, quite like that of *cinerella,* and Meigen states that his material of *Waltlii* consisted of "three quite the same specimens from Bavaria, from Dr. Waltl." It seems evident that Meigen simply renamed *cinerella* as *Waltlii,* as was later stated by Bergroth (1887). This renaming has led to some confusion, and three questions must be answered: is Meigen or Waltl the author of *Diamesa,* what is the date of the genus, and what is the type species? Sublette and Sublette (1965) and Serra-Tosio (1971) attribute *Diamesa* to Waltl (1837), while others have regarded Meigen as the author, sometimes with no date, but usually with 1838. As stated in Waltl (1835), the species listed were "named and described by Meigen," so *Diamesa* Meigen *in* Waltl, 1835, or simply *Diamesa* Meigen, 1835, would be the correct name, author, and date of the genus. Also, because *cinerella* was the sole species of *Diamesa* mentioned in Waltl (1835), albeit in a footnote, *cinerella* is the type of the genus by monotypy (Art. 68(c), International Code of Zoological Nomenclature). Coquillett's (1910) designation of *D. Waltlii* Meigen 1838 as the type species must therefore be disregarded.

The descriptions and figures of *D. cinerella, Waltlii,* and *Gaedii* are too brief and unclear to positively identify Meigen's specimens even to genus, and it is possible that we have misinterpreted *Diamesa.* The types of *D.*

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[2] δια (inter), μεσος (medius) (Agassiz, 1842-1846). I presume Meigen meant to indicate that *Diamesa* was "intermediate" between his genera *Chironomus* and *Tanypus.*

Waltlii were reviewed by Goetghebuer (1923), and, according to him, *Tanypus praecox* Meigen, 1830, is a *Diamesa* and is the male of *D. Waltlii.* He therefore synonymized *D. Waltlii* with *praecox.* Goetghebuer (1923), however, states that the fourth tarsal segment in *Waltlii* is cylindrical, so *Waltlii* can not be a *Diamesa* as we presently understand the genus. Possibly Goetghebuer was mistaken. In any case, Staeger (1845) included a fair description of "*D. Waltlii*" (actually *D. aberrata* Lundbeck), including venational characters, and Walker (1856) included descriptions and one figure of several species presently assigned to *Diamesa* or closely related genera. The genus has been fairly well defined from the time of these workers, and, in the absence of an examination of the type of *Waltlii,* I shall use *Diamesa* in its presently accepted usage, i.e., that of Pagast (1947) or Serra-Tosio (1971). It must be noted, however, that the types of *D.* "*Waltlii*" in the Meigen collection in the Museum of Natural History in Paris are possibly females of some other Diamesinae, and that these types must eventually be reexamined and their identity established to put the use of *Diamesa* on a firm and nomenclatorially correct basis.

The first species of *Diamesa* recorded from the Nearctic was "*D. Waltlii* M." from Greenland (Staeger, 1845). At least one, and probably all, of Staeger's specimens were, however, *D. aberrata* Lundbeck. Shortly thereafter, Fitch (1847) described *Chironomus nivoriundus* from New York State. The description was unclear, and *nivoriundus* has been regarded as either an *Orthocladius* (Johannsen, 1905) or a *Diamesa* (Johannsen, 1903, 1934). Around the turn of the century Lundbeck (1898) in Sweden described *D. aberrata* and *chorea* from specimens from Greenland, and Coquillett (1899, 1905) in the U.S. described two *Diamesa* as *Eutanypus borealis* from Alaska and *Tanypus heteropus* from Colorado. A decade later Muttkowski (1915) described *D. mendotae* from Wisconsin, and Malloch (1915) recorded "*D. waltlii* M." (probably *D. chiobates* n. sp.) from Illinois. Garrett (1925) described several Diamesinae from British Columbia, including *D. banana* and *borealis.* The following year Kieffer (1926) in France described *D. geminata* and *simplex* from material at Oslo collected on Ellesmere Island, and, two years later, Goetghebuer (*in* Remy, 1928a) in Belgium described *D. biappendiculata* from Scorseby-Sund, Greenland. In the 1930's Edwards at the BM(NH) described or recorded several *Diamesa* from the Nearctic. He described *D. davisi, clavata, furcata,* and *gregsoni* and recorded *D. bohemani* Goetghebuer from material brought back to Oxford University from Hudson's Strait (Edwards, 1933), and he described *D. bertrami* and recorded *D. lindrothi* and *?ursus* Kieffer from east Greenland (Edwards, 1935).

Little was done with Nearctic *Diamesa* from then until the late 1950's (Pagast did not treat them in his revision of 1947), when Roback (1957a, 1959) described *D. leona, pieta, caena, onteona,* and *ancysta* and recorded *D. incallida* (Walker) from the western United States. Oliver (1963) recorded *D. arctica* (Boheman) from Ellesmere Island. Sublette and Sublette (1965) summarized the known distribution records and synonymies of the genus, listing 18 species recognized as valid and assigned to *Diamesa* in this study. In the late 1960's Sublette (1966, 1967a, 1967b) published a valuable series of papers redescribing North American chironomid types. This series included several *Diamesa* and made determination of at least these species possible. Finally, Saether (1969) described *D. spinacies* and *fonticola* from Alberta and Manitoba, respectively.

Several other papers included references to described Nearctic *Diamesa,* either as new distribution records, redescriptions, descriptions of immature stages, keys to larvae, etc. These references need not be reviewed chronologically here; they are cited in their respective specific synonymies.

Methodology

Material examined. — Loans: As mentioned, several hundred specimens for this study were obtained on loan from the USNM, CNC, and ANSP, while smaller collections were borrowed from other U.S. institutions (see Acknowledgments). Early in this study it became evident, however, that most museums had few if any *Diamesa* sorted out from undetermined material. I was fortunate, therefore, to be able to personally examine the unsorted material at several university collections and to borrow any Diamesinae from these. Collections examined were: University of Wyoming (Laramie), University of Colorado (Boulder), Colorado State University (Fort Collins), Utah State University (Logan), University of Idaho (Moscow), Washington State University (Pullman), Western Washington State University (Bellingham), and the University of Michigan (Ann Arbor). J. E. Sublette had the entire chironomid collections of several universities, and he kindly let me examine these for Diamesinae. Included here were the chironomid collections from the University of Missouri, University of Kansas, Kansas State University, University of California (Riverside), University of California (Davis), Iowa State University, and the California Department of Public Health.

Collecting. — A fellow student, R. A. Hellenthal, added measurably to my material through his own collecting in the western U.S. in 1968, particularly in California and Montana. Also, E. F. Cook had light traps run at some 12 localities in Minnesota during the warmer months of 1968-1972, and a few of these traps did yield *Diamesa.*

A good part of the material for this study was collected by the author on various short collecting trips in Minnesota and Wisconsin and on a few longer trips to several western states. In August and September, 1967, my wife and I collected in South Dakota, in the Big Horn Mountains in Wyoming, on Mt. Baker in Washington, and in Idaho, Utah, and Colorado. In August, 1968, we again collected in the Big Horns, and in August, 1969, we collected there and in the Bear Tooth Mountains in Wyoming. I also collected briefly in Wyoming and Colorado (March, 1968), New Mexico and Colorado (December, 1968), and Missouri (April, 1969).

Collecting *Diamesa* can be both interesting and challenging, as they often occur only in such inaccessible places as snowfield meltwater streams on mountains or are about during mid-winter — hence their relative scarcity in most collections. Light traps are sometimes quite successful, particularly on warm nights in the spring and fall. They are, however, useless in the winter because the air temperature falls well below freezing by nightfall on days during which the adults emerge and are active. I have taken ten species at lights and presume all *Diamesa* are attracted to lights.

A sweep net can be very successful in collecting adults. I had some excellent collecting near timber line in the Big Horn Mountains by simply sweeping close to the branches of the spruce and fir of the forest or in the small openings between the trees. Actually sweeping or beating the branches of the conifers was sometimes necessary to capture *Diamesa* resting on them. Sweeping vegetation along streams and springs is another sometimes successful collecting technique, as is sweeping above a stream at dusk. Adults often rest on the timbers of bridges spanning small streams and may be swept or aspirated from these. Species with reduced male antennae are often found in fair numbers on rocks in streams, congregating just above the splash line in protected places. One merely turns over exposed rocks in streams and aspirates the insects. While these species rarely try to escape by flying, they can run surprisingly fast. A number of brachypterous specimens of *D. leona* Roback were taken in this manner, except that some had actually crawled into the honey-combed passages of pieces of ice between the rocks (Fig. 35). Wading in a stream and turning over the ice ledges by the stream's edge also exposed some specimens of *D. leona* clinging to the underside of the ice ledge or hiding in recesses in the ice.

All but one specimen of my material of *D. nivicavernicola* n. sp. came, as the name indicates, from a small cavern in a snowfield above timber line on Mt. Baker. The cavern, some one to two meters wide, one meter high, and perhaps 20 meters long, had been cut by a meltwater stream, and it

had scores of *D. nivicavernicola* walking about on its sides and roof, from which they were easily aspirated or removed with forceps.

On a mild winter day, when the air temperature is near or above freezing, *Diamesa* adults are often found sluggishly walking about on the snow by open streams and are easily collected with aspirator or forceps. Where streams are frozen over except for occasional small ice-free holes, one simply collects at these holes, and one can often find numerous pupal exuviae, as well as adults, at the edge of the ice. Adults and pupal exuviae may also be collected on the splash zone of rocks or debris in streams. Occasionally the adults are only partly emerged from the pupae, giving a valuable adult-pupal association.

Diamesa larvae live free or in loose cases of silk and debris on rocks, sticks, etc., in streams. They pupate in a case of silk and debris and usually completely shed the larval skin from the pupa, although the cast larval skin does remain in the silken case. By carefully collecting these cases, therefore, one is able to get at least a larval-pupal association. If the imago is close to fully formed and is a male, the hypopygium is visible within the pupa, and a complete larval-pupal-adult association is found. I have tried rearing larvae or pupae with mixed success and find simply collecting and preserving pupal cases individually is the easiest way to get associations of the various stages.

Drift traps (Figs. 30-32), used so extensively and successfully for collecting stream chironomids by Brundin (1966), were also used by the author and by R. Hellenthal. Their design follows that of Waters (1962). They proved quite useful for taking larvae, pupae, pupal exuviae, and, occasionally, adults.

The "jeep trap" described in Sommerman and Simmet (1965) was used by K. M. Sommerman to take most of the extensive Alaskan *Diamesa* collection received from the USNM. This interesting trap is essentially a series of funnels mounted above an automobile which lead, via plastic tubes, into a collecting cage in the car. The trap catches anything flying in the slipstream above the car as the vehicle is driven at moderate speeds (to 25 mph.) and was eminently successful, taking 11 species of *Diamesa*.

Placing a Malaise trap over a stream or spring or in a woods, although not done by the author, would seem to be an excellent method of collecting *Diamesa*.

Preservation. — The pros and cons of various methods of preserving chironomids have been reviewed by Schlee (1966). At the start of this study I nearly always pointed specimens, but I have since changed to preservation in 80% ethyl alcohol, as was recommended by Schlee, as the easiest and most generally satisfactory method. *Diamesa* are fair sized

chironomids, and specific determinations are usually possible with alcohol specimens. Most pointed specimens, however, must be relaxed and at least the hypopygium cleared in KOH before determination is possible, because the hypopygium dries and distorts. Slide mounts are easily made from alcohol material, at least if the material isn't decades old, and slide mounts are the most permanent way to preserve chironomids and allow the most detailed examination. They are, however, time-consuming to make properly. All things considered, I now feel the best way to treat *Diamesa,* and probably all chironomids, is to collect and preserve the majority in alcohol, but pointing some if possible, clear portions of series in KOH, and slide mount a portion of these cleared specimens. Cleared specimens preserved in alcohol are quite useful, because they allow examination from different aspects. Temporary glycerine slides can also be made from these specimens.

Slide mounting. — Slide mounting of specimens generally followed the procedure of dissection and use of multiple cover slips outlined by Schlee (1966). In my study, the wings of an alcohol specimen were first removed and kept in the 80% alcohol. If pinned or pointed, the specimen was relaxed in a closed jar with a few moist phenol crystals before removing the wings. In either case the body was then heated in 10% KOH for about five minutes, rinsed in distilled water, and then returned to the 80% alcohol with the wings. Wings and body then went to 95% or absolute ethyl alcohol (five minutes), after that to beechwood creosote (two minutes), and finally to balsam on the slide. Quite thin balsam, cut with xylene, was used for initial dissection and orientation on the slide. Four separate areas of balsam (instead of the 11 used by Schlee, 1966) were used on the slide for mounting the various parts. The parts were grouped on the basis of their thickness: the thin wings by themselves, the large thorax and first six or seven abdominal segments together, the head and hypopygium together, and the detached legs and antennae together. The wings were removed from the creosote and positioned in the lower right spot of balsam. The body was then removed from the creosote and laid on its left side in the lower left spot of balsam. The head and hypopygium were detached from the body and positioned in the upper left spot of balsam. In many cases part of the dorsum of the thorax, i.e., the pronotum and mesonotum anterior to the postnotum, was removed from the rest of the thorax and positioned dorsal side up beside the rest of the thorax. The legs from the right side of the body were removed and positioned in the upper right spot of balsam. The antennae (except the scape) were then removed and positioned, one lateral side down, the other medial side down (if possible), with the detached legs. The depth of the balsam

on the slide was less than the thickness of the parts being mounted, so proper orientation, once achieved, was maintained. The slides were then dried for a day or two in an oven (55°C) without coverslips. Coverslips (12 mm diameter, round, #2) were then added, using somewhat thicker balsam. Solid glass beads (0.5 mm diameter) were used to support the coverslips to prevent crushing or distorting the specimens. These beads are considerably neater than fragments of coverslips. The slides were then dried for several days in an oven.

To aid in achieving uniform slide mounts, a small plastic slide holder was constructed with the locations for the various parts of the midge and for the coverslips scratched onto its surface. All slides made, therefore, had the various dissected parts in the same relative position. This permitted rapid comparison of a character in different specimens, for once one slide had been positioned and a character located, often under even high power, another slide could be substituted and the character immediately examined without the need to change to low power and locate the particular character again.

The above procedure or that of Schlee (1966) is slow and tedious, and is not always practical for the average worker who does not have the time of a graduate student or a full time technician available to make his slides. One ends up, however, with specimens thoroughly cleared of muscles and other internal matter and with most characters easily visible. They are also as permanent as a slide can be. It is, I feel, well worth the time to make careful slides using either balsam or euparal. Wirth (1961) and Wirth and Marston (1968) recommend a balsam-phenol technique for mounting chironomids. While the technique may be satisfactory on very small Diptera, I found the scores of balsam-phenol slide mounts of *Diamesa* received from the USNM very unsatisfactory. The muscle tissue was not removed or even made very transparent using this method, and crushing and distortion of parts, including the hypopygium, occurred. The presence of muscles and the distortion made examination of many characters difficult or impossible and the use of the slide as a model for an illustration out of the question. While large numbers of slides may be made in a working day with this technique, few if any are, in my opinion, of satisfactory quality.

Mounting portions of chironomids in Hoyer's solution, as was recommended by Roback (1971: 5), is faster than the balsam method, but the slides must be ringed to achieve any degree of permanence.

Labelling. — The time and effort spent collecting should not be compromised by one final but easily passed over point: proper labelling of specimens. The format I adopted for labelling specimens contains, I feel,

the minimum data needed to adequately and clearly label a specimen. Additional ecological data could be helpful. Data included were: name of country; name of state or province; latitude and longitude to minute; distance from a town; altitude; date; collector; and how collected. Latitude and longitude to minute and altitude to 200′, at least for the United States, are easily obtained from 1:250,000 U.S. Geological Survey maps. These parameters for many other countries should not be difficult to obtain (see Axtell, 1965). Dates are given with the month printed (abbreviated), not as a Roman numeral or arabic number. The abbreviation "leg.", not "col.", is used before the collector's name, because "leg." means "collected by" only, while "col." could imply "in the collection of." A number of such locality labels are typed using a typewriter with a carbon ribbon. The typed sheet is then photo-reduced to about 28% of its original length and printed on 100 lb. bond text paper. A printed label containing the above information measures about 8 × 18 mm and takes up little space on a slide. A figure of a slide showing the arrangement of the various dissected parts and with such a label appears in Fig. 148.

Adult Morphology

General. — Because descriptions, keys, and classifications are based almost entirely on morphological characters, a good understanding of the morphology of the species considered is desirable to both the author and reader of any systematic work. Unfortunately, many terms used in chironomid works are incorrect morphologically, partly from the lack of a thorough morphological study of the adult, and partly for convenience and the avoidance of changing established usages. One is faced, then, with the choice of retaining well-established but incorrect usages or replacing these with different but more morphologically correct terms. Lindeberg (1964), discussing the various interpretations and terminologies of wing venation, urges that "the nomenclature of descriptive taxonomy should not be changed too often," and he urges the retention of well-established terms rather than their replacement with more morphologically correct ones. While stability is certainly desirable, I do not feel that workers should be bound to vague or incorrect usages when, and if, the correct morphological terms are known. Furthermore, a change to morphologically correct terminology would not be that difficult, and it would, in fact, lead to greater stability of terminology once adopted. No one objected when "chest" of Walker was replaced by "sternopleuron" of Osten-Sacken. And yet, the "sternopleuron" contains no sternal elements — it is entirely of pleural origin, although several recent workers have called it simply the mesosternum, which it definitely is not. "Preepisternum II" is

the morphologically correct term, so it is the term adopted in this study. Chironomid terminology is not so stable that a change to correct morphological terms would be difficult. Therefore, when a correct morphological interpretation is possible, I shall use morphological terms, and I urge that these terms be adopted in chironomid systematic literature.

The following study treats the morphology of the adult males of *Diamesa* and is included both as a study of morphology *per se* and to clarify and explain the terms and concepts used in the descriptive part of this paper. Occasionally comparisons with the condition of characters in other groups are included. The morphology section should enable the reader to be certain of what is meant in the descriptions and to compare the terms and concepts used here with those used by other authors. Other studies or discussions of adult chironomid morphology and terminology include Frommer (1967) and Serra-Tosio (1970b), and parts of Mial and Hammond (1900), Schlee (1968), Brundin (1966), Freeman (1955), Fittkau (1962), Saether (1969, 1971), Strenzke (1957a, b, 1959, 1960), and Tokunaga (1932).

Coloration and pruinosity. — Nearly all nearctic *Diamesa,* when alive or preserved dry, are light to dark gray. The medial and lateral scutal stripes appear somewhat darker, particularly when viewed antero-dorsally. These grays may change to browns when specimens are preserved in alcohol. Because of the uniform coloration throughout the genus, I put very little value on color characteristics and note them only briefly or not at all in descriptions.

Fine microtrichia (Fig. 19) on nearly all the sclerites give a slight gray or whitish pruinosity to a dry specimen. The pruinosity is particularly evident between the stripes on the scutum.

Antennae. — Imms (1939) points out that the antennae of insects are of two distinct types: the truly segmented type, found in the Collembola and the Diplura, and the annulated type, found in all higher insects. In the segmented type, intrinsic muscles are present in all but the apical segment, and growth is by division of the apical segment (Imms, 1939; 1940: Fig. 1). In the annulated type, on the other hand, muscles run only from within the head to the basal segment or scape and from the scape to the next apparent segment or pedicel, and growth occurs by divisions of one or more of the proximal "segments" of the flagellum (Imms, 1940). Because the flagellum lacks any musculature and one or more of its proximal divisions may undergo further subdivisions, it seems best to regard the entire flagellum as a secondarily subdivided single segment, and Imms (1939: 316) proposes the term **flagellomere** for its subdivisions. As Snodgrass (1960: 28) emphasizes, these sub-

divisions are not segments in the sense that the antennal scape, the thoracic and abdominal segments, and the femur and tibia are segments, and they therefore should not be termed segments. Whether the pedicel is a true segment or the basal subdivision of a primitive segment forming the antennal distal to the scape is a question. Imms (1940: 591) suggests that the pedicel could possibly "be regarded as homologous with a segment of the segmented type of antenna which has lost its intrinsic musculature." Snodgrass (1960: 30) feels that the pedicel is a true segment and that muscles running from it to the flagellum have been lost. Matsuda (1965: 64) agrees with this interpretation. Following this interpretation, then, the antenna of a chironomid seems best regarded as consisting of three true segments: a ring-like scape, a large, globose pedicel, and a long, slender, multiannulated flagellum.

The plumose antenna of male *Diamesa* has been regarded as 14-segmented, and a particular flagellomere, for example the fourth, would be called the "fifth segment." This terminology is, however, undesirable for two reasons. In the first place, the so-called multisegmented flagellum, as explained above, is actually a multiannulated single segment. Furthermore, the first antennal segment, the scape, has been generally regarded as being "suppressed" and has not been included in counts of antennal "segments." The scape is, however, quite evident, particularly in slide preparations. Therefore, the statement "male antennae 14-segmented" is incorrect both morphologically and numerically and should not be used. Because the scape and pedicel are always present, while the number of flagellomeres may vary, the number of flagellomeres rather than "antennal segments" should be given in descriptions. Furthermore, a particular flagellomere, for example the fourth, should be referred to as the "4th flagellomere" rather than the "5th segment."

While the male antennae of many species of *Diamesa* are highly plumose like those of most other members of the family, reduction in the degree of plumosity, reduction in the number of flagellomeres, and changes in other features of the antennae occur in several species. For clarity, the "typical" or plumose antenna with 13 flagellomeres will be considered first.

The first antennal segment, the **scape,** is ring-shaped and lies in a large membranous area, the **antennal socket** (Snodgrass, 1935: 109) (Fig. 48). Its ventro-lateral margin articulates with an **antennifer** (Fig. 60), a small sclerotized protuberance near the ventromedial margin of the eye. It articulates with the pedicel on two raised points, one dorso-lateral, one ventro-medial (Fig. 48). Similar internally-directed projections serve as sites for muscle attachments. In species with plumose

antennae the scape lacks both microtrichia and setae, although well developed setae are present on the scape in some chironomids, e.g., *Lasiodiamesa arientina* (Coq.) (Podonominae) (Saether, 1969: Fig. 3) and female *Protanypus*. A single **scapal seta** is present in some male *D. leoniella* n. sp.

The second segment, the **pedicel,** is large and globose (Fig. 36). Its distal surface is deeply indented for the reception of the first flagellomere. Unlike the scape, it does bear microtrichia and has from zero to four **pedicelar setae** on a small mound ventro-medially. A single campaniform sensillum occurs at the rim of the indentation for the flagellum (Figs. 5, 41). The pedicel has usually been called the scape or first segment in chironomid literature.

The third antennal segment forms the entire **flagellum** and, in the male, is subdivided into thirteen flagellomeres. The first flagellomere (Fig. 39) is about 1.4 times as long as wide and is inserted into a deep socket in the pedicel. It bears a distinct **basal nipple** proximally and is slightly swollen distally, particularly ventrally. The second and third flagellomeres are slightly fusiform, the fourth to twelfth cylindrical. The second through twelfth flagellomeres become progressively longer — the second is about two to two and a half times wider than long, while the twelfth is about as long as wide. The thirteenth flagellomere is much elongate, being some 15 to 25 times longer than wide and from one to nearly three times as long as the length of the preceding flagellomeres together. The terminal 0.15 to 0.20 of the thirteenth flagellomere is slightly enlarged ventrally, then narrowed at the very tip, or "spindle shaped" (Fig. 37). One (or rarely two) **preapical antennal seta** (= *soie preapical,* SPA, Serra-Tosio, 1970b) is found at the tip of the thirteenth flagellomere.

Each flagellomere except the first bears several very long setae which form the plumose male antennae characteristic of the family. The longest of these setae are some 0.50 to 0.65 times the length of the flagellum, and the setae on the dorsal and dorso-lateral surface of the flagellum (= *soies externes,* SE, Serra-Tosio, 1970b) are both slightly more numerous and longer than the setae on the ventral and ventro-medial surface (= *soies internes,* SI, Serra-Tosio, 1970b). These long setae number from zero to three on the first flagellomere, three to six on the second, five to ten on the third, and about 10 to 14 on the fourth to the twelfth; they are numerous on the thirteenth flagellomere. They are arranged in one slightly irregular whorl on the second flagellomere and in two irregular whorls on the third to the twelfth. On the thirteenth they form no definite whorls. Two to six short setae, in addition to the long setae, occur dorso- and ventro-medially on the first through the fifth or sixth flagellomeres. They

are quite short on the first and second flagellomeres and are easily distinguishable from the long setae. They become progressively longer on each succeeding flagellomere, however, and by the sixth or seventh they are indistinguishable from the long setae (Fig. 36).

The sockets of the flagellar setae are confined basically to the dorsal and dorso-lateral and ventral and ventro-medial regions of all but the last flagellomere, giving two seta-free bands, one medial and one lateral (cf. Serra-Tosio, 1970b: Fig. 1). The medial band runs from the first to the twelfth or even along the basal 0.1 to 0.2 of the last flagellomere. The lateral band runs almost to the very tip of the last flagellomere and, from about the fourth flagellomere distally, is less well sclerotized and is somewhat infolded, forming the **antennal furrow** (= *sillon antennaire,* sa, Serra-Tosio, 1970b; *Fuhlerrinne,* Schlee, 1968). On the last flagellomere the antennal furrow gradually becomes located more dorsally until near the very tip it may even be somewhat dorso-medial.

Numerous microtrichia are present on all the flagellomeres (Fig. 4).

One important measurement involving the antennae has been widely used in chironomid taxonomy, namely, the **antennal ratio** (AR). The antennal ratio, as used here (cf. Fittkau, 1962), is the ratio of the length of the last flagellomere to the length of the preceding flagellomeres together, including the small basal nipple on the first flagellomere (Fig. 47). Lengths are measured only on cleared alcohol or slide mounted specimens. As Saether (1969) points out, this ratio is quite a bit higher for pinned specimens than for alcohol or mounted specimens of the same species because the fine membrane connecting the flagellomeres shrinks in dried specimens. Edwards (1929: 283), for example, roughly estimated antennal ratios from dry material, and his estimates can not be meaningfully compared to those made on alcohol or slide mounted material.

Several types of sensilla are found on the antennae of insects, and the type, number, and location of these sensilla in chironomids have recently been used as systematic characters. Strenzke (1960: Figs. 1-3) recognizes three types of sensilla in *Clunio:* hyaline, finger-like sensilla basiconica (*Sinneskegel,* Sb); similar but shorter, more slender sensilla basiconica (*Sinneszapfen,* Sz); and sensilla coeloconica (*Grubenkegel,* Sc). Schlee (1968: 65, Figs. 208-209) discusses a type of large sensilla coeloconica occurring in *Corynoneura* and other genera whose margin is ringed with microtrichia; he terms this the "Ringformige Sinnesorgane." Serra-Tosio (1970b) recognizes three basic types of antennal sensilla in *D. zernyi* Edw.: hyaline, finger-like sensilla basiconica (*les sensilles chetiformes,* Scf); large, ringed sensilla coeloconica (*les grandes sensilles coeloconiques a microtriches,* SCc); and slender, elongated sensilla coelo-

conica (*les petites sensilles coeloconiques,* scc). He also differentiated the broader, blunter sensilla basiconica, the "sensilles chetiformes larges" (= *Sinneskegel* of Strenzke, 1960) from the more slender, more pointed ones, the "sensilles chetiformes etroites."

Serra-Tosio (1970b: Figs. 2-4) discusses the occurrence and distribution of these sensilla on the various flagellomeres in *D. zernyi.* Except for one difference in interpretation, the occurrence and distribution of these sensilla is the same in species with plumose antennae I have examined and is as follows: one ringed sensillum coeloconicum (Fig. 44, 46) both ventrally and dorsally on Flm_1 and dorsally on Flm_2; two or three small sensilla coeloconica (Fig. 44) on Flm_1 and one ventro-medially on Flm_{2-3}; one broad, blunt sensillum basiconicum just ventral to the antennal furrow on Flm_{1-5}; and one similar but smaller sensillum basiconicum (Fig. 44) ventrally on Flm_{1-3}. Serra-Tosio (1970b) interprets the latter sensilla as "sensilles chetiformes etroites." They seem to me, however, to be Strenzke's "Sinneszapfen" — they arise from a fairly obvious pit and are blunt and much shorter than the "sensilles chetiformes etroites" on the spindle-shaped apex of Flm_{13}. I shall call them small, blunt sensilla basiconica. Serra-Tosio (1970b) points out that each has a small sensillum coeloconicum associated with its base. No sensilla are found from Flm_6 up to the spindle-shaped apex of Flm_{13}. Some 40 to 50 slender sensilla basiconica (as in Fig. 1), usually four to six blunt sensilla basiconica, and about four ringed sensilla coeloconica occur on the spindle-shaped apex of Flm_{13}, while two to four small sensilla coeloconica are found at the very apex of Flm_{13} (Fig. 42).

While the antennal sensilla do not reach the degree of development of the "ascoids" in Psychodidae (e.g., Quate, 1955), they do seem to offer some excellent systematic characters. They are, unfortunately, often difficult to identify correctly or even find without oil emersion. The hyaline, finger-like projections of the sensilla basiconica on Flm_{1-5} are so transparent that without oil immersion and phase contrast all one usually sees are the clear, round sockets of the blunt sensilla basiconica just ventral to the antennal furrow. If the antenna has not been sufficiently cleared, the other sensilla, mostly located between the enlarged setal bases, are difficult or impossible to find. Identification of the sensilla on the spindle-shaped apex of Flm_{13} may also be difficult if orientation and clearing are not correct.

"Reduced" antennae. — Reduction in the number and length of the flagellar setae, in the relative length of the ultimate flagellomere (i.e., a lower AR), and in the number of flagellomeres occur in the males of several species of *Diamesa.* A slightly reduced antenna occurs in *D.*

cinerella Meigen (Fig. 38) and a few other species. Here the ultimate flagellomere is shortened (AR about 0.7), and the long setae, while still about 0.65 times the length of the flagellum, are slightly reduced in number to a maximum of about 10 or 11 per flagellomere. $Flm_{2\text{-}5}$ are slightly fusiform and about as long as wide. $Flm_{6\text{-}12}$ are more cylindrical and progressively longer, and Flm_{12} is about twice as long as wide. The well-developed spindle-shaped apex of Flm_{13} is about 0.4 times the length of Flm_{13}, and the antennal furrow is only weakly developed. The antennal sensilla are as in species with plumose antennae.

More drastic changes are encountered in *D. nivicavernicola* (Fig. 40). The scape and pedicel are reduced in size, the number of flagellomeres is reduced to 10 or 11 (fusion often occurs between two or more of the distal ones), and the longest flagellar setae are only about three times the diameter of the flagellomeres, or some 0.16 times the length of the flagellum. The setae, when present, are arranged in one irregular whorl per flagellomere and number from two to six per flagellomere. Flm_1 is tapered basally and the basal nipple is indistinct. The following flagellomeres are slightly fusiform and progressively shorter, while the ultimate one is distinctly broader and basically cylindrical, with the distal 0.3 tapering to a blunt apex. The AR is down to about 0.35. A large, blunt sensillum basiconicum occurs ventrally at the distal end of each of the first five flagellomeres, while two to five smaller blunt sensilla basiconica occur on the distal regions of each of the flagellomeres but the last (Fig. 4). One to three slender, pointed sensilla basiconica also occur on the three to four preapical flagellomeres (as in Fig. 45). The distal 0.8 of the ultimate flagellomere is covered with numerous long, slender, pointed sensilla basiconica and has about five small, blunt sensilla basiconica and three to five ringed sensilla coeloconica (Fig. 1). All in all, the antenna looks quite like that of a *Clunio* (Strenzke, 1960: Fig. 2).

Even further antennal reduction occurs in *D. leona, D. davisi,* and other species, where only eight flagellomeres are present (Fig. 43). The dorsal region of the scape may be weakly sclerotized, and pedicellar setae are often absent. The shape of the flagellomeres and occurrence and distribution of the sensilla are about as in *D. nivicavernicola.*

Head. — The insect head is a composite structure, formed by the fusion of several segments and the modification of segmental appendages to form feeding organs. Ideally, the segmental boundaries would remain, and naming regions of the head capsule and their setae would be simple and morphologically meaningful. As it turns out, however, sutures delimiting segments in the head are lost, and terminology must be topological and the limits of areas arbitrary.

The large, dorsal region of the head capsule is termed the **vertex.** For our purposes we can regard its borders as the tops of the antennal sockets anteriorly and the top of the occipital foramen (= foramen magnum) posteriorly. The vertex usually bears a prominent Y-shaped **coronal suture** medially (Snodgrass, 1935: Fig. 56A) (Fig. 48). The coronal suture is distinctly produced into the head, forming what are here termed the **coronal apodemes.** Posteriorly the two diverging dorsal arms of the coronal suture end at the occipital foramen and here articulate with the two cervical sclerites. The region between these dorsal arms is termed the **coronal triangle** (Saether, 1971). The coronal triangle bears four short, straight setae arising from large, clear sockets, the **coronal setae** (Saether, 1971). The rear margin of the vertex is also produced dorsad between the arms of the coronal suture, forming a small, pointed triangle (Fig. 48); this triangle is apparently homologous to the **nape** in mosquitoes (Knight, 1970: 28, Fig. 1, Na). The anterior margin of the vertex is simple and distinct in most species. In males with reduced antennae, however, it is produced ventromesad toward the frons and its margin here becomes indistinct or obliterated. It is also produced anteriorly over the scapes in these species, forming what reminds one of misplaced eyebrows (Figs. 52-55).

Two small, clear spots, which appear to be campaniform sensilla, occur medially at the anterior margin of the vertex (Fig. 48). These are, however, possibly much-reduced ocelli. Jobling (1928) shows by sectioning that similar structures in *Culicoides vexans* Staeger (Ceratopogonidae) are actually ocelli and states that "their external structure is essentially similar to that of *Tanypus varius* and *T. choreus.*" Interestingly, Schiner (1864a, footnote on p. XXVIII) noticed "Spuren von Punctaugen" in a few species of *Tanypus.* In the absence of an examination of a section of these organs in *Diamesa,* I shall regard them as probably being small but apparently true ocelli.

The **labrum** in *Diamesa* is non-sclerotized and indistinct (Fig. 48). (A well-sclerotized labrum is present, however, in all Podonominae I have examined.) Immediately above the labrum is the sclerotized **clypeus,** delimited dorsally by the **epistomal** (= frontoclypeal) **suture** running between the anterior tentorial pits (Fig. 48). Above the clypeus is the triangular **frons.** A slender but strong bar, here termed the **interantennal bar,** is usually present, extending dorsad from the frons to the vertex along the mid-line of the head. It seems to be the remains of the mid-region of the epicranial suture and any interantennal sclerotization pushed to the midline of the head by the enlargement of the antennal sockets. Knight (1970: 27) terms it the interantennal groove in culicids. It is not a groove, however, but a slender bar, and I therefore prefer interantennal

bar. It is reduced or absent in males with reduced antennae (cf. Figs. 48, 51-55).

Five more-or-less definite setal groups are present on the head of *Diamesa:* the clypeal, interocular, inner vertical, outer vertical, and postocular setae (Figs. 48, 49). In a few specimens of *D. aberrata, spinacies, leona,* and *haydaki,* one or two additional setae, here termed the **medial vertex setae,** also occur, located antero-medially on the vertex (Fig. 51). The number of clypeal setae varies from two to fifteen, being lowest in species with much-reduced male antennae. When numerous, they form no definite groups. If few, however, they may be in two lateral groups (cf. Figs. 48, 51-55). The **interocular setae** (Knight, 1970) (= *soies preoculaires,* Serra-Tosio, 1968: Pl. VII, Fig. 2; Saether, 1971: Fig. 2D) form, in species with plumose antennae, a fairly well-defined group near the dorso-medial margin of the eyes (Fig. 48, 51). In males with reduced antennae, however, the group is more dispersed and located more mesad on the vertex and is sometimes not easily distinguishable from the inner vertical setae (Figs. 53-55). While "preocular" has been used for these setae, "pre-" means before or in front of, and the interoculars are between, not in front of, the eyes. I therefore prefer the term "interocular" which better describes the location of these setae. Vertical setae (Saether, 1971) occur on the vertex on either side of the coronal suture and above and just behind the dorsal part of the eyes. Saether (1971) somewhat arbitrarily divides the vertical setae into inner and outer verticals. In many species of Diamesa, however, the outer verticals are fairly easily distinguishable; they are longer, stouter, straighter, and more erect than the inner verticals and are longer and stouter than the postoculars (Figs. 48, 49). The outer verticals usually merge with the postoculars (= postorbitals), which form a more-or-less uniserial row just mesad to the posterior margin of the eye (Fig. 49). Saether (1971) suggests that the term temporal setae be used to designate the vertical plus postocular setae.

The large **compound eyes** possess coarse, upright microtrichia between, but not on, the ommatidial lenses (Figs. 48, 52-55). These may be longer than the height of the ommatidial lens, in which case they are easily visible under a dissecting microscope and give the eye a "hairy" appearance. In other species they are much shorter, and, at least under a dissecting microscope, the eye appears "bare" (Fig. 51). In all "bare"-eyed species of *Diamesa* I have examined, however, the microtrichia are present, particularly fronto-medially, as is quite evident in slide mounted specimens. Hence "hairy" and "bare" are not absolute terms, but are, instead, extremes in development of these microtrichia. Therefore, in this paper, "hairy" means that the microtrichia are longer than the height of an omma-

tidial lens and are easily visible along the lateral margin of the eye when the head is viewed from the front. "Not hairy" means that the microtrichia are shorter than the height of an ommatidial lens. Genuinely bare eyes, with no microtrichia at all, occur in *Prodiamesa* (Schlee, 1968).

The shape of the dorso-medial margin of the eye is an important systematic character. In some genera of Diamesinae a dorsal "bridge" some three to five ommatidia high and six to eight ommatidia long extends mesad above the antennal sockets (Fig. 50). In *Diamesa* the eyes are not produced medially. The dorso-medial margin is somewhat truncate in species with plumose antennae (Figs. 48, 51), more broadly rounded in species with reduced antennae (Figs. 52-55). In species with plumose antennae a **dorsal ocular apodeme** may extend mesad from the lower corner of the dorso-medial margin of the eye (Figs. 6, 51). This apodeme is an offshoot of an internal ridge, the **ocular sclerite** (Peterson, 1916: 23, Figs. 142, 145, 147, 149, 154), which runs along the medial and dorso-medial margin of the eye (Fig. 6). A heavily sclerotized, pointed projection, the **ventral ocular apodeme,** extends mesad from the ventral margin of the eye in species with plumose antennae (Figs. 48, 51, 60). In species with reduced antennae, however, the ventral ocular apodeme is absent, and the antero-ventral margin of the eye contacts the tentorium (Figs. 61, 62).

The prominent **tentoria,** visible internally in cleared specimens, have recently been used in chironomid systematics (Schlee, 1968). The tentoria are formed by invaginations of the integument, two anterior (at the lateral ends of the epistomal suture) and two posterior; these unite within the head to form two tubes (Snodgrass, 1935). The points of invagination appear as holes, known as the anterior and posterior tentorial pits. In species with plumose antennae, the tentoria are swollen basally (i.e., at the anterior tentorial pits) but have a more slender, slightly tapered dorsal region (Figs. 48, 60); they also extend just slightly dorsad beyond the posterior tentorial pit. In males with reduced antennae, the tentoria are much more tube-like, that is, the basal region is not swollen (Figs. 61, 62). Schlee (1968) noted a similar trend in *Corynoneura* and other Orthocladiinae and Chironominae. The swollen basal region possibly serves as a point of attachment of muscles running to the antenna and is therefore greatly enlarged in species with large plumose antennae. Saether (1971: Fig. 3) and Schlee (1968: 148) illustrate the tentoria of several genera of chironomids.

Mouth parts. — The mouth parts of *Diamesa,* like the vast majority of chironomids, are modified to form a fluid-ingesting apparatus, and mandibles are completely lost. However, Downes and Colless (1967) recently noted mandibles in an undescribed Australian chironomid with an "un-

usually elongate proboscis," possibly a Podonominae. This species certainly warrants a more detailed examination.

The **maxilla** in *Diamesa* is, by my interpretation, represented by a **stipes, lacinia,** and five-segmented **palpus.** Saether (1971: 1245) feels that the cardo has fused with the stipes in *Diamesa* and other genera but is partially or completely delimited from the stipes in a few genera, particularly *Lasiodiamesa* (Podonominae). Examination of a *Lasiodiamesa* shows the stipes extending dorsad toward the posterior tentorial pit, with an apparent cardo running first mesad, then dorsad, to fuse with the tentorium at the posterior tentorial pit. Imms (1944: 82) emphasizes that "the close association of the cephalic articulation of the cardines with the posterior tentorial pits is a very constant feature among Nematocera"; Crampton (1942: 33) and Peterson (1916: 37) say essentially the same thing. Peterson (1916: Figs. 257, 259, 260, 261 and 262) illustrates a separated cardo and stipes, with the cardo touching the sclerotized region of the head capsule at the posterior tentorial pit, in several genera of Nematocera. Peterson (1916: 37) states that the stipes in *Chironomus* is connected to the posterior tentorial pit by a slender sclerotized process extending from the stipes and states that this is a reduced cardo. In *Diamesa,* however, the dorsal-most portion of the maxilla is far removed from the posterior tentorial pit, and the region between it and the posterior tentorial pit is entirely membranous (Fig. 49). I feel, therefore, that the cardo has been lost and that the dorsal-most projecting region of the maxilla is still part of the stipes, in contrast to the interpretation by Saether (1971: Fig. 1B).

The stipes in *Diamesa* is produced mesad as a flat plate (Figs. 49, 56). Peterson (1916: 38), as pointed out by Saether (1971: 1245), states that these projections fuse medially to form a continuous plate in *Chironomus ferrugineovittatus* Zett., although Saether (1971) states that this does not occur in any species of *Chironomus* he has examined. These projections do not meet medially in any *Diamesa* examined.

The **first palpal segment** articulates just dorsad to the ventral tip of the stipes (Fig. 56), while the endite lobe, interpreted as the lacinia by Imms (1944: 82-86), articulates to the very ventral tip of the stipes. The lacinia is slender, blade-like, and fairly transparent and bears several seta-like projections at its tip (Figs. 12, 56) (cf. Saether, 1971: Fig. 1C).

The long, prominent maxillary palpi have been described as being four-segmented by all workers except Tokunaga (1936) and Malloch (1915: 410) who, I feel, correctly treat them as having five true segments. That the palpi of chironomids are primitively five-segmented seems evident on close examination of the palpus in a number of genera of chirono-

mids and on comparison with the palpi in other Nematocera and other panorpoid orders. For example, five definite palpal segments are present in the mecopterans *Boreus* and *Nannochorista* (Crampton, 1942: Fig. 2B, 2I) and many Nematocera (Peterson, 1916: Figs. 258, 260, 261, 262, 264, 270; Crampton, 1942: Figs. 2C, 2H, and 2K). An obvious landmark mentioned by Crampton (1942: 34) and Imms (1944: 75, 86-88) is a peculiar **sunken organ** on the third segment in *Nannochorista* (Mecoptera) and many Nematocera. This sunken organ occurs in many chironomids, e.g., most Diamesini, Tanypodinae (Fittkau, 1962: 18), and at least some Podonominae (Brundin, 1966: 75), presumably on the second segment. It seems improbable that this distinctive and widespread organ has moved to another segment in chironomids, however, and close examination of the palpus in *Diamesa* shows, in addition to four well-sclerotized, setous segments, a small but still distinct basal segment. This true first segment is particularly obvious in *Protanypus,* where it is well-sclerotized and bears long setae. In most *Diamesa* the sclerotization of this segment is weaker, and setae are usually absent. This first true segment is, however, obviously present, and it is the segment articulating to the stipes (Fig. 56). In other chironomids the segment may be fairly well-sclerotized and may bear setae (Saether, 1971). So while some chironomids have four well-sclerotized, setous segments, the primitive number is five, and the degree of development of the first segment should be noted in descriptions.

The palpi in *Diamesa* range from fairly long and slender, as in *D. spinacies* (Fig. 51) or *mendotae* (Fig. 56), to quite short and stout, as in *D. leona* (Figs. 55, 57). This can be expressed quantitatively by dividing the length of the palpus from the base of PS_2 to the tip of PS_5 (Fig. 57) by the sum of the widths of palpal segments 2-5; the quotient is here termed the **palpal stoutness.** Long, slender palpi have a high (4.5) value for palpal stoutness, while short, stout palpi have a low (about 2) value.

When present, the "sunken organ" is on the third, not the second, segment. The structure of the "sunken organ" has been described for the ceratopogonids *Culicoides* (Jobling, 1928) and *Forcipomyia* (Barth, 1961). A scanning electron photomicrograph of the organ in *D. mendotae* shows about 30 curved, slightly capitate sensilla arising from a hemispherical pit (Figs. 7, 8, 9, 29). In many chironomid genera which lack this sunken organ there are, instead, several long, slender, pale sensilla, often about at the same location as the sunken organ (cf. Serra-Tosio, 1971: Fig. 138.3; Schlee, 1968: 61). These sensilla seem essentially like those described by McIver and Charlton (1970) on the fourth palpal segment in culicids.

Rowley (1972) has published several scanning electron photomicrographs of the sunken organ in five species of *Culicoides,* and McIver (1971, 1972) and McIver and Charlton (1970) have studied capitate sensilla on the fourth palpal segment in culicids. The external structure of the capitate sensilla in the sunken organ in *Culicoides* is quite similar to that in *Diamesa,* except that in *Culicoides* the distal "head" is more abruptly expanded and the sensilla are less densely arranged within the pit. Two of Rowley's photomicrographs (Rowley, 1972: Figs. 6, 8) show that the individual sensilla arise from small ringed pits; I did not observe this in *Diamesa,* possibly because the sensilla are too closely arranged to see their bases. The surface of the "head" of each sensillum in *Diamesa* is gently wrinkled (Figs. 8, 9), as it is in *Culicoides* (Rowley, 1972: Fig. 11). McIver and Charlton (1970) and McIver (1972) show that the capitate sensilla on the fourth palpal segment in mosquitoes have numerous small (150-180Å) pores on the surface, and Baessler (1958) and Kellogg (1970) have shown that these sensilla, at least in *Aedes aegypti* (L.), are sensitive to CO_2.

Rowley (1972) suggests that the sunken organ in *Culicoides* functions at least in part in detecting CO_2 and suggests that the larger number of sensilla in the sunken organ of ornithophilic species of *Culicoides* reflects a need for the detection of small amounts of CO_2 from a small prey. Mammalophilic species of *Culicoides,* on the other hand, require fewer sensilla because of the greater amounts of CO_2 given off by their larger prey.

The function of this obviously well-developed sunken organ in *Diamesa* is, however, more difficult to explain. It would scarcely be used to detect CO_2 from a prey, and its use as an olfactory organ for food detection seems tenuous, especially when one considers the lack of food available in midwinter when several species of *Diamesa* do emerge.

A single (campaniform?) sensillum occurs medially at the distal end of the second palpal segment (Fig. 56); Schlee (1968: 61-62) states that this sensillum occurs in all Orthocladiinae and Tanypodinae.

Palpal segments two to five bear setae some one to three times as long as the width of the segment, and they also bear fairly coarse, grouped microtrichia (Figs. 7, 48, 56, 57). The setae on the fifth palpal segment are much shorter than those on the preceding palpal segments; they apparently are the "Halbstarre' Borsten" Schlee (1968: 61) reported in several genera of Orthocladiinae.

The **labium** in *Diamesa* is essentially like that of "*Tendipes* sp." illustrated by Hoyt (1952: Figs. 49A, 50). The large, fleshy, indistinctly

two-segmented **labella** were shown by Crampton (1923) to be reduced labial palpi, while the pair of sclerites dorsal to the labella are the prementum (Fig. 49). Peterson (1916: Fig. 312) termed the prementum the theca and the labella the paraglossae in *Chironomus*. Saether (1971: Fig. 1B) illustrates the labium of a *Trissocladius*.

The sclerotized internal parts of the feeding apparatus are the tormae, two strengthening sclerites on the epipharynx (Figs. 11, 59), the cibarial pump, and the labial lonchus. The two **tormae** (= *Befestungen des Kopfinnenplatte,* Schlee, 1968: Fig. 86) extend from the dorsolateral margin of the labrum postero-dorsad to articulate with the cibarial pump (cf. Peterson, 1916: Fig. 531, 532; Saether, 1971: Fig. 4; Schlee, 1968: 59, Fig. 86) (Fig. 59). The **cibarial pump** (Snodgrass, 1959; Saether, 1971) (= *basipharynx,* Peterson, 1916; *pharynx,* Jobling, 1928; *Kopfinnenplatte,* Schlee, 1968; *plaque cephalique interne,* Serra-Tosio, 1970: Fig. 1.2) is a prominent, well-sclerotized rectangular structure with pointed, produced dorsal corners or cornua (Saether, 1971: 1243) (Figs. 48, 58, 59). Ventrally the cibarial pump appears to be produced as a slender triangle, interpreted as the hypopharynx by Peterson (1916: Figs. 531 and 532). Hoyt (1952), as pointed out by Saether (1971), shows that this slender triangle is labial in origin and is better termed the **labial lonchus.** It contains the opening of the salivary duct or **orifice** (= *Porus,* Schlee, 1968) (Saether, 1971) and is fringed with setae distally (Figs. 11, 58, 59). A scanning electron photomicrograph shows that the epipharynx also bears numerous setae distally (Fig. 11). Because the labial lonchus and epipharynx are normally appressed, it is impossible to differentiate the setae on the labial lonchus from those on the epipharynx on most slide mounted specimens. A nearly transparent **pharyngeal pump** (Snodgrass, 1959: Fig. 24) (= *oesophageal pump,* Peterson, 1916: Figs. 531 and 532) is often visible above the cibarial pump (Fig. 58).

While chironomid adults have been regarded as being nonfeeding (e.g., Thienemann, 1954: 244), a well-developed pump for ingesting liquids is obviously present, and the presence of a salivary duct implies some digestion of ingested material occurs. Although I have not seen *Diamesa* feeding at flowers or such semi-fluid food as rotting fruit, decaying vegetation, etc., I have watched them drink droplets of water, and the possibility of ingesting some type of liquid for actual nourishment is certainly possible. Malloch (1915: 288) holds that chironomids visiting flowers are obtaining food there, as "is evident by their actions." If adult chironomids do ingest water or liquid food, the setae and seta-like projections on the labial lonchus, epipharynx, and end of the lacinia (Figs. 11, 12) seem to be adapted to straining particles from such ingested fluids.

Thorax. — The thorax, like the head, is formed by the fusion and differentiation of segments and the incorporation of parts of the appendages. This process of tagmosis has not, however, led to quite the obliteration of segmental boundaries as in the head, and the various sclerites are more easily recognized and homologized.

Many of our present morphological terms for the thorax of insects, such as epimeron, episternum, prescutum, and others, date all the way back to Audoin (1824) (reviewed, compared to other early works in MacLeay, 1830). Somewhat later Osten-Sacken (1881, 1884) proposed a more topological terminology for the pleural sclerites and for the chaetotaxy of the thorax in Diptera, and his terms were adopted by many Dipterists. More thorough studies of the thorax, notably by Crampton (1914, 1919, 1925a, 1925b, 1926a, 1926b, 1942), Young (1921), Matsuda (1956, 1960, 1970), Michener (1944), Ferris (1940a, 1940b, 1950), Snodgrass (1909b, 1927), and Weber (1924, 1928), however, have given us a far better understanding of the origin and evolution of this tagma. Rather than continue using Osten-Sacken's topological terminology, which has been used for the thorax of chironomids and other Diptera, I am applying the interpretations of the above morphologists to the thorax of *Diamesa* and am adopting the morphological terms proposed by them.

Because interpretation and correct naming of the sclerites of a thoracic segment are possible when one understands the basic origin and evolution of the segment, a brief review of the fundamental morphology of the thoracic segments seems worthwhile.

The dorsal sclerite or notum of a wing-bearing thoracic segment is primitively bounded front and rear by an **antecostal suture** externally and an intersegmental **phragma** projecting internally (Snodgrass, 1935: Figs. 36, 39, 96; Matsuda, 1970: Fig. 6) (Fig. 63). According to Snodgrass (1935: Figs. 96, 97), a secondarily membranous strip just before the posterior phragma separates the more posterior, phragma-bearing acrotergite or **postnotum,** which has no connection with the wing, from the more anterior, wing-bearing **alinotum** (= *eunotum,* Crampton, 1942). The alinotum is in turn divided by transverse sutures into an anterior **prescutum,** a medial **scutum,** and a posterior **scutellum** (Snodgrass, 1935: Figs. 96, 100; Matsuda, 1970: Fig. 3). The prescutum is primitively a narrow transverse band delimited anteriorly by the antecostal suture and posteriorly by the transverse or prescutal (Snodgrass, 1935: 180) or **prescutoscutal suture** (Matsuda, 1970: 12). The largest region of the alinotum is the scutum, set off anteriorly by the prescutoscutal suture and posteriorly by the V-shaped (Snodgrass, 1935) or **scutoscutellar suture** (Snodgrass, 1935; Mat-

suda, 1970). The scutum is in turn partially or completely divided by one or more sutures (Matsuda, 1970: Fig. 3). A pair of **parapsidal sutures** and a pair of **lateral parapsidal sutures** extend posteriorly from the prescutoscutal suture, and the **anterolateral scutal suture** sets off a small sclerite, the **suralare,** which bears the **anterior notal wing process.** The wing attaches to the lateral margin of the scutum. The scutellum follows the scutum and laterally bears the **axillary cords** (Snodgrass, 1935: Fig. 100A), which extends along the rear margin of the squama (Fig. 89).

Because it bears no wings, the pronotum is simpler. It bears no phragma anteriorly (Snodgrass, 1935: Figs. 87, 97), and it lacks the extensive sutures of a wing-bearing notum.

The lateral or pleural region of a thoracic segment has apparently been derived from the proximal region or subcoxa of the coxa (first postulated by Heymons, 1899; elaborated by Weber, 1928; Snodgrass, 1927; Ferris, 1940b; and others). Matsuda (1970: Fig. 14) proposes a pleural region formed of two rings. A slightly modified version of this primitive pleuron appears in Fig. 67. The principal landmarks of this primitive pleuron are the **pleural suture** running from the dorsal coxal articulation to the pleural wing process; a **paracoxal suture** (= pleural costa, Ferris and Pennebaker, 1939; precoxal suture, Michener, 1944) separating the outer (anapleural) ring from the inner (katapleural) ring; and an **anapleural suture** separating the **anepisternum** from the **preepisternum,** Ferris (1940a, b) emphasizes the importance of the ventral coxal articulation arising on the katepisternum (i.e., on a portion of the pleuron and not on the sternum) and the line of meeting of the two preepisterna of a segment on the ventral midline or **discrimen.**

We find a bit more controversy concerning the sternum. Snodgrass (1935) postulates a **spinasternum** on the intersegmental line and a segmental **eusternum** (Fig. 68). A pair of internal **sternal apophyses** project into the thorax from the eusternum (Snodgrass, 1935, Fig. 92). The origin of each sternal apophysis is visible externally as a pit, the **sternal apophyseal pit** (Fig. 68). An internal apodeme or ridge, the **sternacosta** (Snodgrass, 1935: 170, Figs. 93, 94), runs between the two sternal apophyseal pits and divides the eusternum into an anterior **basisternum** and a posterior furcasternum or **sternellum** (Figs. 13, 68). Crampton (1942) is in basic agreement. Snodgrass (1935: 172), however, feels that in the pterothorax of higher Diptera, "the more primitive sutures of the sternal as well as the pleural areas have become almost obliterated and secondary grooves appear which divide the skeletal surface into parts that have little relation to those in more generalized orders." Ferris (1940b), on the other hand, claims that the thorax in Diptera and other orders is much more easily

explained and claims that in only a few insects is a truly sternal sclerite, i.e., one arising independently between the subcoxal arcs, ever visible externally in the pterothorax. The sternal sclerites, Ferris holds, are invaginated into the thorax on the ventral midline in the pterothorax, and the mid-ventral region is formed instead by the ventral regions of the converging subcoxae. I basically agree with Ferris.

The prothorax in *Diamesa* is represented externally by notal, pleural, and, with even Ferris agreeing, sternal elements, and internally by a slender transnotal apodeme or ridge, a pleural apodeme on each pleuron, and two sternal apophyses. The pronotum is divided transversely into an anterior pronotum or **antepronotum** and a posterior pronotum or **postpronotum** by a **posterior transnotal suture** (Matsuda, 1970: Fig. 130B) (Fig. 64) (cf. Crampton, 1925a: particularly Figs. 33, 35, 39, and 40). The posterior transnotal suture is produced internally slightly to form a slender transnotal ridge (Fig. 71). The antepronotum in chironomids has been referred to as simply the pronotum. The antepronotum is formed from two sclerites which fuse medially, forming the **medial commissure** (Figs. 71, 78). The antepronotum extends but little anteriorly beyond the large scutum, and it is normally divided dorso-medially by a distinct notch (Figs. 78-81). This notch is usually a simple acute V, with the point of the notch at or just slightly anterior to the scutal process. In species with reduced male antennae, however, the notch may be quite obtuse, and the point of the notch may be located slightly behind and below the scutal process, giving a so-called "gaping" antepronotal notch (Fig. 86). In some specimens of *D. leona* the notch is absent and the dorso-medial region is simply membranous (Fig. 87), while in many brachypterous specimens of this species the antepronotal halves broadly fuse dorso-medially, completely eliminating any notch (Fig. 88). This condition is unique, to my knowledge, in the Chironomidae. Serra-Tosio (1971: 183, Figs. 71, 77) reported the closely-related European species *D. steinboecki* Goetgh. as having the antepronotal halves widely separated. As Saether (1969) points out, the shape of the medial notch may vary a good deal within a genus or even a species, as is shown in Figs. 78-81. In species with plumose male antennae, the fore margin of the antepronotum is fairly straight, and lateral antepronotal setae are confined to the antepronotum's lateral-most region (Fig. 78). In species with reduced male antennae, however, the anterior margin of the antepronotum is concave anterolaterally, giving the fore margin a sinuous outline, and the lateral setae are more dispersed mesad (Figs. 86-88). A slender bar usually extends a short distance mesad from the antero-ventral margin of the antepronotum (Fig. 71).

The postpronotum is divided into two lateral regions which appear, at first glance, to be part of the scutum (Fig. 64). Indeed, they have been regarded as such — they are the "humeral callosities" or "humeri" of higher Diptera (e.g., Curran, 1965). These lobes are fairly well delimited from the scutum by an antecostal I suture postero-dorsally, but they fuse with the scutal area dorsally and the mesopleural area ventrally. In most species of *Diamesa* a long, slender apophysis, here termed the **postpronotal apophysis,** extends internally from the posterodorsal region of each postpronotal sclerite (Figs. 13, 71, 78). From its location, I would interpret this apophysis as a derivative of the lateral ends of the intersegmental phragma. A small, clear spot at the postero-dorsal margin of the postpronotum apparently marks the region of invagination of the postpronotal apophysis. This spot could thus be termed the **postpronotal apophyseal pit** (Fig. 64).

The postpronotum in *Diamesa* bears no setae or other obvious structures. Along its antero-dorsal border are a few tiny spots (Fig. 64), possibly campaniform sensilla. Saether (1971: Figs. 5 and 6) indicates that similar small structures occur in *Parachaetocladius* and *Rheocricotopus,* and Coe (1950: Fig. 195a′) figures a "prothoracic sensory pit" on the postpronotum in several subgenera of *Chironomus.*

Turning to the pleural region, one sees a well-defined sclerite located ventral to the antepronotum (Fig. 66). **Pleural suture I** runs approximately horizontally across this sclerite and divides it into two regions, a postero-ventral epimeron I and an antero-dorsal region, which would appear to be episternum I. Ventro-mesad to the apparent episternum I, however, but separated from it by a membranous region, is another sclerite which bears the ventral coxal articulation (Figs. 69, 71). This sclerite is, thus, **katepisternum I,** so the two regions of the more dorsal sclerite would then be **anepisternum I** and **epimeron I** (Fig. 66). The latter is not divided into an- and katepimeral regions. The internal **pleural ridge I** is produced antero-ventrad well beyond the margin of epimeron I; at the very end of this projection is the dorsal coxal articulation (Figs. 66, 71). Anepisternum I is produced into a long arm running antero-mesad (Fig. 71), and the cervical sclerite articulates to this elongation of anepisternum I. Viewing the thorax ventrally (Fig. 69), the katepisterna I are seen to fuse with a sclerite which bears the pair of internally-directed sternal apophyses. This sclerite is thus **eusternum I** and is the only externally-visible sternal element in the thorax of *Diamesa.* Eusternum I fuses with the antero-ventral regions of the preepisterna II and is divided approximately in half by an internal ridge running transversely across the sclerite. This internal ridge seems to clearly be the **sternacosta** (Snodgrass, 1935: Figs. 92A,

93C), and the sternal apophyseal pits extend antero-laterad from the ends of this ridge. Eusternum I is thus divided by the external mark of this ridge, or the **sternacostal suture,** into an anterior **basisternum I** and a posterior **sternellum I** (Figs. 13, 69).

The strong **sternal apophyses,** visible in cleared specimens, extend to and fuse with pleural ridge I (Fig. 71). (Saether, 1971: Fig. 5, st I, mistakenly labelled the sternal apophyses as sternum I). About halfway up their length each sternal apophysis bears a slender mesal projection, while the dorsal half of the lateral border fuses with pleural ridge I (Figs. 13, 71). The sternal region of the prothorax is thus solidly fused with the pleural region.

The externally-visible sclerites of the greatly enlarged mesothorax are all of either notal or pleural origin — any sternal sclerites have been invaginated into the cavity of the thorax on the mid-ventral line. The notal regions are the prescutum, the scutum (the so-called "mesonotum"), the scutellum, and the postnotum. As Crampton (1942) emphasizes, the notal region of the mesothorax, that is, the true mesonotum, extends from the anterior to the posterior mesonotal phragma (Fig. 65). The use of the term mesonotum to designate the scutum is not correct and should not be followed.

The **prescutum** in Diptera has been variously interpreted. Crampton (1925a: Figs. 11-14, others, *psc;* 1942: 46-48, Figs. 6A, C, E, F, *psc*), Hendel (1928: Figs. 18-20), and Weber (1966: Fig. 197b) regard the anterior portion of the scutum as the prescutum. Crampton (1942: 47) defines the prescutum as the region of the insertion of the longitudinal flight muscles. Snodgrass (1935: Fig. 101D, E) and Matsuda (1970: 13, Figs. 130A, B, 132A), on the other hand, interpret the prescutum in Diptera as having been separated or much constricted medially and pushed laterally by the extreme anterior development of the scutum. To interpret the prescutum, let us look again at some landmarks on the primitive notum (Fig. 63). Note that the antero-lateral scutal suture, the lateral parapsidal suture, and the lateral end of the prescutoscutal suture meet at one point. Matsuda (1970: 13) emphasizes that this point of meeting is an important landmark, and it is a landmark we can easily find in *Diamesa.* By locating the tergal fissure, anterior notal wing process, and first axillary sclerite, we can find the suralare near the rear of the scutum (Fig. 64). The anterior end of the suralare meets the lateral parapsidal suture, so the prescutoscutal suture would be the suture extending along the lateral margin of the scutum, and the prescutum would be the long, slender sclerite just below this suture. While the prescutum is small in *Diamesa,* it is quite well de-

veloped in other *Nematocera* (cf. Crampton, 1925a: Figs. 33, 37, 39, 40, *pat*$_2$). The prescutum is the paratergite of Crampton (1925a, 1942) and Knight and Laffoon (1970b).

The main dorsal sclerite of the thorax of a chironomid is the scutum, morphologically but scarcely topologically posterior to the prescutum. The scutum in *Diamesa* is partially subdivided by two pairs of incomplete sutures. A short **parapsidal suture** (Matsuda, 1970: Figs. 3, 130, 132A) with an internal apodeme arcs dorsad from the lateral scutal margin just above the anterior spiracle (Fig. 64), while the **lateral parapsidal suture** (Matsuda, 1970: Figs. 3 and 132A) or supraalar suture partially sets off the **supraalar callus** (Fig. 64). The posterolateral scutal suture (Matsuda, 1970: Figs. 3, 130A, B, 132A) is absent.

The **scutum** bears three darkened areas or "stripes," one medial and two lateral, marking the insertion of the longitudinal and vertical flight muscles, respectively (cf. Freeman, 1955: Fig. 2). In dry material these stripes appear slightly darker and have less pruinescence than the rest of the thorax. In cleared specimens of many species they are scarcely discernible. The antero-medial margin of the scutum is usually slightly produced anteriorly, forming the **scutal process** (= *Mesonotalfortsatz, mesonotal process,* auct.) (Fig. 78). A small roughened or tuberose oval area, the **humeral scar,** is located just anterior to the dorsal end of the parapsidal suture (Fig. 65). About at the base of the parapsidal suture the scutum projects slightly laterad, forming the **scutal angle** (Knight and Laffoon, 1970b) (Fig. 78). A similar lateral projection, the **prealar callus,** occurs just before the wing (Fig. 78).

Only two groups of setae are normally found on the scutum of *Diamesa.* The **dorsocentral setae** (DCS) (= *Dorsolateralborsten*) are typically arranged uniserially in two parallel, longitudinal rows. Often they are slightly staggered posteriorly, particularly if numerous (e.g., *D. mendotae,* Figs. 82, 83). What appear to be tiny clear dots (?*Fensterfleckchen,* Schlee, 1968) also occur in or near the dorsocentral setal rows (Figs. 7, 82, 85). In *Diamesa* the number of dorsocentral setae per row varies from one (in *D. leoniella*) to over 20 (*D. mendotae*). Just dorsal and anterior to the wing are the **prealar setae,** confined to the posterior region of the prealar callus. **Acrostichal** (= *dorsomedial, Dorsomedianborsten*) **setae** are consistently present only in *Diamesa leoniella. D. leona* occasionally has a single acrostichal seta, and one specimen of *D. lindrothi,* Goetgh. examined has a single acrostichal seta.

The **supraalar callus** bears no setae in *Diamesa,* although **supraalar setae** are present there in other chironomids. These setae have been called

the "Postalarborsten" (Pagast, 1947). Brundin (1956), however, correctly points out that these setae are above, not behind, the wing, and should thus be termed "supra-," not "post-," alar. The region also bears an interesting little postero-lateral patch of short, stout microtrichia which, when the wing is folded, contacts a similar group of microtrichia on the end of the third axillary sclerite (Figs. 19, 89). The supraalar callus also has a distinct fissure laterally, the notal incision (Crampton, 1928: 114, Figs. 1-4) or **tergal fissure** (Matsuda, 1970: 312, Figs. 130, 132A) (Figs. 64, 92).

The **scutellum** bears little of systematic interest except the scutellar setae, which vary in arrangement, number, and length (cf. Figs. 65, 75, 76, 86-88).

The posterior-most division of the mesonotum, the **postnotum,** bears no setae in *Diamesa* and is divided antero-medially by a medial fissure or cleft (Figs. 73, 78). Interestingly, this medial fissure is reduced or even absent in some brachypterous specimens of *D. leona,* as it is in the subfamily Podonominae. The postnotum also usually has a definite suture on the mid-line postero-ventrally (Fig. 72). The postnotum, viewed laterally, usually has a fairly sharp postero-dorsal corner (Fig. 64); in some species with reduced male antennae and in *D. lindrothi,* however, the postero-dorsal margin is rounded (Fig. 76). The intersegmental phragma, or phragma II, appears as a ventral extension of the postero-lateral regions of the postnotum (Figs. 64, 72). This phragma is scarcely developed in the brachypterous form of *D. leona* (Fig. 76) because of the loss of the longitudinal flight muscles.

The remaining external regions of the mesothorax are all of pleural origin. Remembering our landmarks, we can start at the dorsal articulation of coxa II and trace the internal **pleural apodeme II** running antero-dorsad to merge with a strong internal ridge or apodeme which runs between preepisternum II and katepisternum II (Fig. 66). This latter apodeme is an internal projection of part of the paracoxal suture (Matsuda, 1970: 35 and Fig. 14); it is here termed the **paracoxal apodeme.** Pleural suture II then continues in a conspicuous straight course to the pleural wing process. Near the ventral end of the vertical portion of pleural suture II is the **pleural apophyseal pit,** marking the origin of the **pleural apophysis** (Fig. 66). Pleural suture II divides the mesopleuron into an anterior episternum II and a posterior epimeron II.

Actually, the dorsal coxal articulation and lower-most part of the pleural suture have undergone an interesting posterior displacement in chironomids, and one could possibly mistake the suture between epimeron II and anepisternum III (Fig. 66) as the pleural suture. The straightest pleural suture II I have observed is in the Podonominae. In *Lasiodiamesa*

(Fig. 77), for example, pleural apodeme II merges with the strong paracoxal apodeme at a fairly acute angle. In other genera pleural apodeme II forms nearly a right angle with the paracoxal apodeme.

A strong **anapleural suture** runs from near epimeron I to just above the pleural apophyseal pit and separates the more dorsal **anepisternum II** from **preepisternum II.** Anepisternum II is in turn divided into three regions. The anterior region is postero-ventral to the mesothoracic spiracle and fuses antero-dorsally with the postpronotum; it is here termed **anteanepisternum II.** It is often weakly sclerotized anteriorly, and in many species this weakly sclerotized region forms a more or less distinct opening, the **anteanepisternal pit** (Fig. 66). The posterior region of anepisternum II, or **postanepisternum II,** is a triangular sclerite just anterior to the upper part of the pleural suture. These two anepisternal regions are separated by a large membranous area in which is found a large, well defined sclerite This sclerite, here termed the **medioanepisternum II,** bears a strong apodeme dorsally (Fig. 91) and is connected to the scutum by a small sclerite, the **prealare** (Crampton, 1925a: Figs. 2, 13, 14, 16, 20, *pra*) (Fig. 66). In nearly all *Diamesa* its ventral margin is smoothly rounded and well defined. In *Lasiodiamesa,* however, the medio- and post-anepisternum II are separated only dorsally (Fig. 77). They are also only partially separated from each other in *Protanypus* (Crampton, 1925a: Fig. 35).

A well defined **basalare** (Fig. 66) is connected to post-anepisternum II by a thin bridge.

The large sclerite below the anapleural suture, often called the "mesosternum," is **preepisternum II.** Viewed laterally, preepitsernum II is usually broadly rounded antero-ventrally and a distinct, long anapleural suture is present (Fig. 66). In brachypterous *D. leona,* however, this border is nearly straight from sternellum I to near coxa II, where it bends sharply dorsad (Fig. 76). Serra-Tosio (1971: 184, Fig. 71) observed the same condition is *D. steinboecki.* The anapleural suture is much reduced in these forms, as it is in the "Clunioninae" (Wirth, 1949). Apparently this reduction in the length of the anapleural suture is connected with brachypterism and a walking rather than flying existence with copulation occurring on the ground. The reduction has occurred independently in *Diamesa,* "Clunioninae," and possibly other brachypterous chironomids. Schlee (1968) noted a trend to a shortened anapleural suture in some *Corynoneura,* and Brundin (1956: 45) mentioned the same in a few other genera.

Viewing the thorax ventrally, one sees the preepisterna II meeting on the ventral midline, termed the discrimen by Ferris (1940a) (Fig. 69).

While setae are, as a rule, absent from preepisternum II in *Diamesa,* a

few small, dorsal preepisternal II setae occur in some specimens of *D. leona, leoniella,* and *davisi* just ventral to the anapleural suture (Fig. 75). Serra-Tosio (1971) reported the same in *D. steinboecki.*

The remaining division of episternum II, **katepisternum II,** is quite small but still visible in many Culicoidea (sensu Stone, et al, 1965). Crampton (1925a) shows it in his Figs. 27, 29, 30, 33, 37, 39, 40, and 41. Interestingly, one can pick out the Culicoidea in Crampton's figures by merely looking for the presence of katepisternum II or "ptn" of Crampton (Fig. 29, a *Bibio,* is the sole exception). In *Tipula reesi* (Rees and Ferris, 1939: Fig. 78) and *Sphaeromias* (Fig. 70) katepisternum II is seen extending in an unbroken arc between coxa II and preepisternum II from the dorsal to the ventral coxal articulation. In *Diamesa* the middle part of this arc has been lost, leaving only a slender region near the dorsal coxal articulation and a small ventral portion (cf. Figs. 66, 69). The latter bears the ventral coxal articulation and fuses with its homologue from the other side to form a ventro-medial plate (Fig. 69). This ventro-medial plate in Diptera, if named at all, has usually been regarded as being sternal (e.g., Knight and Laffoon, 1970b: 135, Fig. 24, *Mes;*). The presence of the ventral coxal articulation, however, seems to me to clearly show a pleural origin for this sclerite, as Rees and Ferris (1939: 149-150) strongly advocated.

Epimeron II bears a slight protuberance postero-dorsally, and this usually bears a few fine setae (Fig. 66). In many species there is a small, pale area just behind the end of the anapleural suture.

The greatly reduced metathorax is more difficult to interpret. Running antero-dorsad from the dorsal coxal articulation is a small sclerite, probably formed by the fusion of **preepisternum III** and **epimeron III** (Fig. 74). This same sclerite extends as a slender bridge ventrally between coxa II and III. Viewed ventrally, it is seen to fuse with its homologue from the other side, forming, as in the mesothorax, a ventro-medial plate bearing the ventral coxal articulations (Fig. 69). This bridge is thus **katepisternum III.**

The large sclerite just posterior to epimeron II, containing the metathoracic spiracle in a large membranous region, would seem to be **anepisternum III.** It is moderately produced laterally along its postero-dorsal margin (Fig. 72). Immediately above anepisternum III, supported on a finger-like process, is the haltere. Because it is a reduced wing, the haltere should have pleural suture III running to its base. One can not, however, easily trace a pleural suture or pleural apodeme in most species. What is possibly pleural suture III is shown in Fig. 74.

To interpret the metanotum, bear in mind that the wing attaches to the lateral margin of the scutum. Since the haltere is reduced wing, the haltere would obviously attach to the lateral margin of the scutum of the metanotum. We know, therefore, that the small sclerite just mesad and dorsad to the base of the haltere (Figs. 73, 74) is in part or totally metascutal. Since a prescutum III is not discernible, I would interpret this small sclerite as being **scutum III + prescutum III.** A small sclerite just behind it would seem to be **scutellum III** (Figs. 73, 74). The postnotum of the metanotum is more easily seen and identified. Dissection shows the longitudinal dorsal muscles of the metathorax running from the rear surface of phragma II to the area shown in Fig. 72. This would, therefore, be **phragma III,** and the small region anterior and the thin region dorsal to it are thus **postnotum III** (Figs. 72-74).

Each thoracic segment bears four internal projections or apophyses, two pleural and two sternal (Weber, 1933: Fig. 120; 1966: Fig. 44a; Snodgrass, 1935: Fig. 92A) (Fig. 68). In the meso- and metathorax of most Pterygota the bases of the sternal apophyses are approximated and fused together, forming the Y-shaped **furcae** (Snodgrass, l.c.; Weber, 1933: Fig. 134). These furcae in *Diamesa* show up only in cleared specimens and really need to be removed for proper observation. They are rather pretty little structures (Fig. 72), although their inaccessability prevents their common use in descriptions. Tokunaga (1932) illustrates and discusses the sternal apophyses in *Pontomyia pacifica.*

Wings. — Except for the brachypterous form of *D. leona,* the wings of all nearctic *Diamesa* extend to or nearly to the end of the hypopygium. When at rest, they are folded to resemble an acute "peaked roof" over the abdomen, with their rear margins touching (Fig. 149). In species with plumose antennae, the wings are fairly slender, there is a slight narrowing of the wing posteriorly just distal to the anal lobe, and the anal lobe is slightly acute (Fig. 93). In species with reduced antennae, on the other hand, the wing is proportionally much broader, the narrowing of the wing just distal to the anal lobe is less pronounced, and the anal lobe is right-angled or obtuse (Figs. 98, 99).

The dry wings of a pinned specimen show iridescent coppers, violets, greens, and blues under reflected light; under transmitted light they are just slightly opaque. This coloration is related to the size of the microtrichia on the wing membrane (Edwards, 1929: 336). In *Diamesa* the microtrichia appears as numerous closely spaced dots at about 100 × and usually appear as short, stout, hair-like structures at 650 ×.

Edwards (1929: 336) used the size of the wing microtrichia to separate subgenera or species groups. Except for the extremes in microtrichia

length, I have found this character difficult to use. Wings with very large microtrichia, such as *Boreoheptagyia lurida* (Garrett) (Fig. 14, 15), appear "punctured" when examined dry. The wing microtrichia in *Potthastia* (Figs. 17, 18), on the other hand, need a very high magnification (900 ×) to be seen. A wing with such fine microtrichia appears, when dry, slightly white or "milky" under a dissecting microscope; in alcohol it is nearly transparent. Between these extremes are "finely punctured," "slightly opaque," "faintly grayish," etc. Long, very short, and moderately-developed microtrichia are shown in Figs. 14-18.

The border of the wing bears a fringe of setae. These are short and slightly curved along the anterior border but become long and straight along the posterior border, where they alternate, one long, one or two short. They are longest on the anal lobe. The squama is also heavily fringed with setae. At the very anterior base of the wing is a membranous **tegula,** covered with microtrichia and several campaniform organs, while just distal to the tegula is a sclerotized **humeral plate** (Snodgrass, 1935: Fig. 122) (Fig. 89). Between the fringed anal lobe and the squama is the **alula.** This lacks any fringe of setae in male *Diamesa* except in the unusual *D. nivicavernicola* where four to nine alular setae are present.

Wing venation characters have been extensively utilized in chironomid systematics, both in descriptions and classification. Several different systems of naming the wing veins have been used during the last 130 years, however, making it sometimes difficult to understand older descriptions correctly. Subcostal and cubitus, for example, have been used by different authors for quite different veins. In addition, different opinions on the correct homologies of the veins and crossveins have led to different terminologies.

Such early authors as Fabricius, Meigen, or Zetterstedt made little use of venational characters in chironomids. Walker (1856) did utilize both configuration and coloration of wing veins, but his terminology is unclear. Schiner (1862: X-XV, Taf. I, II) carefully explained his venation terminology and even diagrammed a chironomid wing. Schiner (1864b) subsequently proposed a similar interpretation, but he here named rather than numbered the veins. His system was adopted by Kieffer and, in his earlier papers, by Goetghebuer. Skuse (1883, 1889) followed the terminology proposed by Loew (1862).

Comstock and Needham (1898, 1899) showed the important role of pupal or nymphal tracheae in vein formation and added greatly to our understanding of venation. Their terminology, borrowed from Schiner and other early authors, was adopted by many workers. Comstock and Need-

ham's interpretation of the branching of the media and cubitus in Diptera, however, was criticized by Tillyard (1919), who showed that the media is actually four- rather than three-branched. Most chironomid workers continued to follow the Comstock-Needham system. Tokunaga (1936) adopted Tillyard's modification quite early, as Freeman (1955) and Oliver (1959) did later. More recently Lindeberg (1964) argues that part of Tillyard's modification may not be correct and points out that the "base of M_{3+4}" of Freeman and Oliver may be a secondarily acquired cross-vein. Lindeberg (1964) further argues that R_1, R_{2+3}, and R_{4+5} are possibly actually R_1, R_2, and R_3, respectively. Until further studies give conclusive evidence for changing the terminology of the radial branches, I shall follow essentially the Tillyard modification of the Comstock-Needham system, except for calling "base of M_{3+4}" "apparent m-cu." A few of the various terminologies and interpretations used by different authors are outlined in Table I (pp. 145).

The venation of *D. mendotae* is typical of the genus and is shown in Fig. 93. The costa (C) does not reach the base of the wing; it becomes distinct about at the humeral cross vein (h) and from there runs along the fore margin of the wing to extend beyond the end of R_{4+5} about six times its own diameter (Fig. 145). It ends just before the wing tip. The strongly concave subcosta (Sc) is very weak and appears like a fold proximally; it all but disappears distally.

The basal 0.1 of the radius is enlarged and strongly sclerotized. Viewing the wing ventrally shows that the radius is closely associated with the base of the subcosta to form what Lowne (1890-92: 199, 201-202, Pl. X, 2) termed the **remigium** (= *Stammader,* Schlee, 1968: 69; stem vein, Edwards, 1929: Fig. 1; *not* remigium *sensu* Snodgrass, 1935: 225). The remigium (Fig. 89) may be likened to a forearm and hand. The proximal end of the remigium fits something like a cupped hand over strong dorsal projections of the first and second axillary sclerites. Immediately distal to this cupped region the remigium is quite weakly sclerotized, forming a line of flexion (at the anterior end of the line of flexion *bf* of Snodgrass, 1935: Fig. 122), something like a wrist joint. Distal to this the "forearm" region of the remigium is strongly sclerotized and inflexible; at its "elbow" region it is tapered to a point. A small, strong, L-shaped sclerite, interpreted as the **arculus** by Wirth (1952), is found at the tip of the remigium (Figs. 89, 90). The proximal region of the arculus lies along the anterior margin of the elbow, while the distal end swings around the elbow and extends posteriorly to the base of Cu. A small extension of this tip usually extends beneath the base of Cu (Figs. 89, 90). Rodova (1971: 43) suggests that the arculus acts as a pivot or hinge, as is indeed seen to be the

case. One can flex the extended wing of a *Diamesa* on its longitudinal axis and see that, while the hand of the remigium itself does not move, rotation of the wing occurs at two points. First, the forearm rotates slightly, pivoting on the weakly sclerotized wrist. Most of the rotational movement of the wing, however, is seen to be about the elbow of the remigium, and one can see that the posteriorly-projecting hook of the arculus serves to connect the anterior and posterior regions of the wing and help them flex as a unit.

The hand of the remigium, in *Diamesa,* bears one to four fairly strong setae. One or two weak setae are usually found just distal to the wrist, and, just distal to these, is a group of about four small and about ten even smaller sensilla, probably campaniform sensilla. A row of three fairly large campaniform sensilla and a group of from eight to twelve smaller campaniform sensilla and from one to four setae occur near the distal end of the remigium (Fig. 90).

The main truck of the radius emerges from the anterior region of the arculus and runs parallel to the costa until r-m. Here it forms three branches. R_1 and R_{4+5} are strong, convex veins which reach the wing margin. R_{2+3}, however, is weak and concave and all but fades out before the costa.

Connecting R_{4+5} and M is a strong, convex, slightly arched "r-m cross-vein." In many slide mounts one can see a trachea running through r-m, so r-m seems to me to actually be part of R_{4+5}. If the so-called R_{4+5} is actually R_3 as Lindeberg (1964: Fig. 6) suggests is possible, "r-m" may have resulted from the loss of the true R_{4+5} as shown in Figs. 94-97. Further evidence for interpreting the posterior branch of R as R_3 is the presence in most Diamesini of a darkened, convex band just anterior to the distal third of M_{1+2} (cf. Lindeberg, 1964: Fig. 6). In female *Pagastia orthogonia* Oliver this band bears a number of setae. According to Tillyard (1918: 634), the presence of setae suggests that this is a remnant or vestige of a vein, in this case R_5. A weak concave fold midway between "R_{4+5}" and M_{1+2} is possibly a vestige of R_4, while a possible vestige of M_2 appears as a convex, darkened band just posterior to M_{1+2} (cf. Lindeberg, 1964: 150, Fig. 6). In many female *Pagastia orthogonia* both the "vestige of R_4" and the "vestige of M_2" also bear setae, at least distally.

The media emerges simply as a trachea from the base of Cu just distal to the arculus; it briefly arches anteriorly, then straightens and runs to the r-m cross-vein (Figs. 89, 93). Just beyond r-m it weakens and runs as a weak, transparent vein to the margin of the wing, ending just behind the wing tip. The apparent m-cu cross-vein is little more than a trachea, with

no sclerotization or brown coloring except at its very ends. In favorable material one can trace this trachea running along the rear margin of the squama, across the base of the alula, to the strong base of Cu, and thence in Cu to where it leaves and joins M (Figs. 89, 93). This trachea looks enough unlike a vein that Singh (1958) described two Diamesini from Nepal as an *Orthocladius* and a *Trichocladius,* stating for the former that "position of mCu cross-vein with tracheal spiral." Lindeberg's (1964) suggestion that this so-called m-cu is actually a secondarily acquired cross-vein seems reasonable.

M_{3+4} is pale and fairly straight; it fades just before the wing margin. The cubitus (Cu) originates at the rear end of the arculus. It is pale basally but becomes slightly brown near "apparent m-cu." Cu_1 is pale and straight basally, but it curves posteriorly slightly at its distal end. Just behind Cu is a fold, quite strong proximally but becoming weaker beyond apparent m-cu; this is the **vannal fold** (Snodgrass, 1935). A very weak anal vein extends to very near the tip of Cu_1.

In addition to configuration, other characters of venation are useful. C, R_1, the basal part of R_{2+3}, R_{4+5}, r-m, and M just proximal to apparent m-cu are quite brown; the rest of the veins are pale. R_1, R_{2+3}, and R_{4+5} bear small campaniform sensilla (= stigmal sensilla, Saether, 1971) and several setae; the number and arrangement of both of these are useful. The subcosta also bears a few sensilla ventrally just beyond the arculus (Fig. 90).

The axillary sclerites at the base of the wing conform very well to the basic pattern given by Snodgrass (1935: Fig. 122) and Matsuda (1970: Fig. 4). After one becomes a little familiar with them, they can be easily homologized with those of *Tabanus* (Bonhag, 1949: Fig. 16), *Tipula* (Rees and Ferris, 1939: Figs. 82A, B), and the species illustrated by Crampton (1928: Figs. 1-4). Again looking for definite landmarks, one can locate the first axillary sclerite by finding the anterior notal wing process (Snodgrass, l.c.: ANP). This is a small, short projection located just below and behind the prealar setae on the posterior-most region of the suralare (Figs. 64, 92). Favorable slide mounts or dissections show an anterior finger-like projection of the first axillary sclerite lying over the ANP. This projection articulates with the antero-ventral region of the hand of the remigium, that is, to the region apparently formed by the subcosta (Fig. 89). The enlarged posterior region of the first axillary is just barely visible from above as a brown sclerite lying nearly vertically; it articulates with the pleural margin of the supraalar callus just posterior to the tergal fissure (Fig. 92).

One can most easily find the second axillary sclerite by viewing the thorax from the side and following the pleural suture dorsally to its end, the **pleural wing process** (Snodgrass, 1935; Fig. 91B, *WP*) (Figs. 66, 91). A ventro-lateral projection of the second axillary articulates to the pleural wing process, while a dorsal projection supports the posterior margin of the hand of the remigium (Fig. 89). The second axillary also articulates to the first axillary along its dorso-medial margin.

By extending and folding back a wing of an alcohol specimen, one can easily find the main **line of flexion** (Snodgrass, 1935: Fig. 122, *bf*) along which the axillary and main part of the wing fold when the wing is flexed back along the abdomen (Snodgrass, 1935: Fig. 133). This line of flexion marks the location of two plates. The **distal median plate** (Snodgrass, 1935: Fig. 122, *m′*) has a rather clear connection to the rear margin of the forearm of the remigium just distal to the wrist. The **proximal median plate** (Snodgrass, l.c., *m*) is smaller and is simply a proximal continuation of m′; the line of flexion between these two plates is sclerotized but flexible (Figs. 19, 89).

The third axillary sclerite is less well defined. It occupies approximately the basal half of the squama and extends from the base of the wing to an interesting raised area on the base of the squama which is covered with numerous short, slightly curved or hooked microtrichia (Figs. 19, 20, 89). This structure, as pointed out by Rodova (1968, 1971), helps fasten the wing to the body when the wing is at the rest position. The third axillary articulates posteriorly to a fairly well defined **posterior notal wing process** (Snodgrass, l.c., PNP) (Fig. 89). Anteriorly it articulates to the second axillary. When the wing is extended, the third axillary is approximately horizontal. Flexion of the wing back along the body involves swinging the distal end of the third axillary, i.e., approximately the region of the microtrichia-covered hump, dorsad and mesad until the third axillary stands approximately vertically (cf. Snodgrass, 1935: Fig. 133). The patch of hooked microtrichia on the third axillary and that on the supra-alar callus are then in contact, and the wing is held in the rest position by the interlocking hooked microtrichia.

Halteres. — The halteres consist of a slightly swollen base or **scabellum,** a slender stalk or **shaft,** and an expanded distal **capitellum** (Crampton, 1942). In *Diamesa* the scabellum and most or all of the shaft are usually brown, while the capitellum is a pale white or light yellow. Although earlier workers usually noted the coloration of the halteres, this character seems quite variable in *Diamesa.*

Legs. — The legs of insects consist of six true segments: the coxa, trochanter, femur, tibia, tarsus, and posttarsus. Although the trochanter

in *Diamesa* is solidly fused to the femur, the trochanter is primitively a musculated, freely articulated segment (Snodgrass, 1935: 197). The tarsus, on the other hand, is like the flagellum; it is a secondarily-subdivided single segment, and its subdivisions are termed **tarsomeres** (Snodgrass, 1935: 198).

In naming the locations of setae, spines, or spurs on the legs, I prefer to follow the terminology proposed by Grimshaw (1905). (Osten-Sacken, 1881: 127, credits Mik, 1878 as proposing this terminology; I have not seen Mik's paper). Grimshaw suggested that each leg be regarded as extending in a straight line horizontally at right angles to the longitudinal axis of the body. The upper surface of the leg is termed dorsal, the lower ventral; the surface facing toward the front of the insect is termed anterior, that toward the rear, posterior. In life the mid and hind legs in chironomids are held more or less along the side of the abdomen, so the morphologically posterior surface is facing medially (Fig. 149). The two long spurs at the apex of the hind tibia have been termed medial and lateral, or inner and outer, as indeed they are when the insect's legs are in the rest position. Using Grimshaw's terminology, however, the lateral and medial tibial spurs are the antero-ventral and postero-ventral spurs, respectively. Similarly, the "medial comb" on the apex of the hind tibia would be called the posterior comb.

The **fore coxa** (Cx I) is deeply notched dorsally, and the dorsal coxal articulation, at the end of an extension of the pleural ridge, fits into this notch (Fig. 66). Postero-distally, just proximal to a projection articulating to the trochanter, Cx I bears three to six strong setae, while about 10 to 16 setae occur along the antero-distal border. Cx II is much longer and more slender than Cx I, and it tapers to a single pointed articulation dorsally (Fig. 66). One can see a weak **meron** partially separated from Cx II posteriorly (Fig. 66) and a small, triangular internal projection, probably a reduced coxal-trochantinal articulation, anteriorly. Just distal to this projection is a group of about 12 pale setae with prominent, clear bases. The distal end of Cx II is somewhat produced mesad. The antero-distal border bears about 16 setae. Cx III is shorter and broader than Cx II and is rounded dorsally. About eight pale setae occur at about 0.3 of its length on its anterior border, much as in Cx II. The antero-distal setae number about 10 to 12.

The **trochanters** are all fairly similar in shape. Each bears a weakly sclerotized area postero-proximally in which are found three to five clear campaniform sensilla. A long, pointed projection of the femur is fused to the distal 0.3 to 0.5 of the trochanter antero-ventrally. A few setae occur ventral to this fused projection; slightly more setae occur dorsal to it.

Three sensilla basiconica and a group of about six sensilla, apparently campaniform sensilla, occur antero-dorsally near the distal end of the trochanter.

The **femora,** like the trochanters, are quite similar. The surface is covered with coarse microtrichia arranged in groups of three to five. Setae are also present; they are most numerous dorsally and ventrally. At about 0.2-0.5 of the fore femur (Fe I) of most species with plumose antennae are about eight to fourteen setae which are conspicuously longer than those nearby, forming what could be called a weak **femoral beard.**

The **tibiae** are more slender than the femora; each bears setae and grouped microtrichia (Fig. 22), as with the femora. The fore tibia (Ti I) bears one ventral terminal spur (Figs. 105, 106), the mid tibia (Ti II) bears two subequal ventral terminal spurs, and the hind tibia (Ti III) bears two ventral terminal spurs, the antero-ventral one being about 0.7 times the length of the postero-ventral one (Figs. 21, 109). In species with plumose antennae, the spurs are long and slender and the basal 0.3 to 0.6 is sparsely to well covered with small, sharp projections or "prickles" (Sublette, 1967a). In some species with reduced male antennae the spurs, particularly on Ti II, are much shorter and stouter (cf. Figs. 105-107). Each tibial spur also has a sensillum (campaniform sensillum?) basally; the sensillum looks like a small, clear oval. In species with plumose antennae the distal half of Ti III bears a region of short, stout setae posteriorly (Figs. 21, 22, 109). These setae are fewer and are in a narrower band proximally but become more numerous and cover much of the posterior surface of the tibia near its distal end (Figs. 21, 109). They possibly aid in cleaning the legs and antennae. Posteriorly Ti III bears a "comb" of some 15 to 25 long, stout, spine-like setae (Figs. 21, 109). Just proximal to the postero-ventral spur on Ti III the integument is usually marked with a polygon pattern (Fig. 109); a similar pattern is sometimes present on Ti I.

The **tarsomeres** ("tarsal segments") bear setae and grouped microtrichia. Ventrally the first two or three tarsomeres bear from two to twenty-six **spiniform setae** (= *Stacheln,* Pagast, 1947; *Sohlenstachel,* Fittkau, 1962; *tarsal spines,* Saether, 1969; *soies spiniformes,* Serra-Tosio, 1971; *Starre Borsten,* Schlee, 1968) arranged more or less in pairs in two irregular rows (Fig. 108). The proximal three tarsomeres are basically cylindrical. The fourth tarsomere (Tm_4), however, is slightly expanded and more membranous disto-ventrally, and this expanded region is covered with numerous microtrichia. The dorso-lateral regions are constricted just before the apex, and the articulation of Tm_5 is in a definite dorso-distal

indentation. The distinctive shape of Tm_4 has been termed "cordiform" (heartshaped), although the shape is certainly more complex than a simple heart. This cordiform condition may be less developed in species with reduced antennae. The dorso-lateral constrictions in particular may be less pronounced or even absent. Tm_5 is somewhat elliptical in cross-section, being somewhat flattened laterally.

The **posttarsus** (= *pretarsus,* de Meijere, 1901; Knight and Laffoon, 1970c: 177, discuss the use of post- rather than pretarsus) in *Diamesa* consists of the claws, empodium, possibly pulvilli, and unguitractor (Snodgrass, 1935: 198-200) (Fig. 23). Each of the two tarsal claws bears several seta-like spines basally and, in species with plumose male antennae, several apical teeth (Figs. 23, 24). In *D. nivicavernicola* the claws have an additional tooth dorsally (Fig. 25), while the claws in most species with reduced antennae lack the apical teeth. A long, fringed empodium emerges from between the two claws (Figs. 23, 25). Very small pulvilli seem to be present in some favorable slides of some species.

The legs in species of *Diamesa* with plumose male antennae are long and slender, and the fore leg ranges from 0.86 to 1.27 times as long as the body. The legs in species with reduced antennae are proportionally longer — in *D. leoniella,* for example, the fore leg is about 1.58 times the body length. The extreme is *D. nivicavernicola,* with a fore leg 1.71 times the body length. Mani (1972) notes that "the adults of nearly all eutorrenticole species have extraordinarily long legs that enable them, on emerging, to retain a firm hold on the submerged and securely anchored pupal case while the wings are spread out to dry in the air before take-off for flight." The larvae of species of *Diamesa* with reduced male antennae in the adult generally live in thin films of water on rocks in torrents, so it at least seems possible that the long-legged condition in these species could give the emerging adult enough time to momentarily stand above the water surface and expand the wings before flight.

The considerable thickening of the legs in the brachypterous form of *D. leona* is also noteworthy (cf. Figs. 102-104, 146-147).

Several ratios expressing the relative lengths of the leg segments have been used in chironomid systematics. These ratios are illustrated in Fig. 146.

Genitalia. — The correct homologies of the external genitalia in insects are, to say the least, still not clear. Saether (1971) has mentioned some of the interpretations and problems of terminology of the genitalia and has applied some of the recent ideas and terms of Smith (1969, 1970a, 1970b), plus adding some of his own terms, to the genitalia of chironomids; several of his suggestions are followed here.

The male *Diamesa* hypopygium consists of the modified tergite and sternite of the ninth segment, the paired ventrolateral appendages of the ninth segment, the median intromittant organ and the various sclerites associated with it, and the remains of the post-genitalic segments. The ninth segment differs markedly from the preceding ones. The ninth tergite is shortened and narrowed, and its lateral and anterior margins are often poorly delimited, while the ninth sternite is much shortened medially and is produced up and around the sides of the abdomen (Fig. 131). The ninth sternite bears setae dorsolaterally, and the ninth tergite bears setae laterally. Usually the ninth tergite possesses an **anal point** (Fig. 131). This may be a mere short projection of the posterior margin of the ninth tergite with no accompanying internal structures, as in *D. aberrata* (Fig. 112a). More often, however, the anal point is as long as or longer than the ninth tergite and is strengthened by internally-directed apodemes continuing from the base of the anal point antero-laterad on the underside of the ninth tergite, as in *D. bohemani* (Fig. 115). The anal point may bear a **terminal peg** at its tip or, rarely, within an apical cavity (Fig. 112a). In some species a dorsal "keel" is present on the distal region of the anal point (Fig. 115). The anal point is usually directed posteriorly, although in *D. leona* it is nearly vertical (directed ventrally) and is thus difficult to see in many slide preparations (Figs. 116, 117). Wensler and Remple (1962) consider the anal point to be the tenth tergite.

The **gonocoxite** (Smith, 1969) (= *basistyle, Basalglieder,* etc.) is essentially a cylinder opening proximo-dorsally into the body cavity (Fig. 126). Its large opening is here termed the **basal foramen.** The gonocoxite articulates loosely to the dorsolateral extensions of the ninth sternum, and the dorsal and lateral border of the basal foramen is strongly sclerotized and somewhat produced inward, forming the **coxapodeme** (Saether, 1971) (Fig. 126). While the simplest gonocoxite in *Diamesa,* as seen in *D. simplex* (Fig. 111), lacks any pronounced lobes or appendages, the gonocoxite in other species bears several structures. In many species the mesal border of the basal foramen is expanded mesad to form a flat **basal plate** (= *Basalanhange,* Pagast, 1947: Abb. 45, *b;* (?)*Dritte Spange,*[3] Schlee, 1968: 80, Abb. 32, 162-167) (Figs. 125, 126). The basal plate bears numerous short, stout microtrichia and sometimes setae ventrally (Figs. 27, 28). It is hidden in dorsal view by the ninth tergite but is visible ventrally. Posterior to the basal plate, on the medial or dorsomedial region of the gonocoxite, is usually found a poorly sclerotized field of setae

[3] Saether (1971: 1249, Figs. 7, 8, 9) interprets the "Dritte Spange" as the aedeagal lobe (see below). I believe, however, that Saether (1971: Figs. 7A, 8B) applies "aedeagal lobe" to two different structures.

and microtrichia. This is weakly developed in *D. aberrata* (Fig. 112a), for example, but is better defined in *D. incallida* (Fig. 110). In *D. spinacies, mendotae, ancysta,* and other species the distal end of this region is free from the gonocoxite (e.g., Figs. 27, 125, 130, 133). Pagast (1947: Abb. 45, a_1) calls this region the "oberer Coxitanhang;" its homologue in other insect groups is unclear, and I hesitate to apply Smith's terminology to it as Saether has done. I shall call it the neutral **medial field.** Species in the *latitarsis*-group (Serra-Tosio, 1967b), such as *D. lindrothi* (Fig. 137), have one or more finger-like, seta-bearing medial or dorso-medial projections on the gonocoxite.

Several species, such as *D. mendotae, nivoriunda,* and *ancysta,* have a prominent tuft of extremely strong, long setae arising on a mound usually located just ventral to the basal plate (Fig. 128); this group is here termed the **basimedial setal cluster.** *D. ancysta* has, in addition, a few strong setae on an ill-defined mound just ventral to the medial field (Fig. 125).

Setae occur over most of the gonocoxite, as do microtrichia; the latter are irregularly grouped in sets of three to six. A strong **basal wedge** (= *Penis* Pagast, 1947: Abb. 45, *p*) (Fig. 131) is usually found between the very bases of the gonocoxites. The antero-dorsal margin of the basal foramen projects slightly and fuses with a bridge-like sclerotized member which connects the two gonocoxites. Wensler and Remple (1962) interpret this bridge as the "transverse apodeme of the tenth sternite" (TAP), Schlee (1968) terms it the "Bogenspange," and Saether (1971) calls it the **sternapodeme.** The sternapodeme in *Diamesa* takes a variety of shapes. In *D. lindrothi* (Fig. 137) and others in the *latitarsis*-group (Serra-Tosio, 1967b) it is simply slightly arched. In other species, such as *D. mendotae,* it has projections antero-laterally (Fig. 130), while in species with much reduced antennae, such as *D. leona,* it is quite triangular (Fig. 116).

The **gonostylus** (Smith, 1969) (= style, dististyle, etc.) inserts in the membranous disto-dorsal region of the gonocoxite and normally folds forward (the exception is *D. nivicavernicola*), as is the case in the Orthocladiinae, Tanypodinae, and Podonominae. It normally bears a short, stout **subterminal peg** or spur (= *Griffe*). In *D. davisi* and *amplexivirilia,* several tooth-like serrations are also present on the distal end of the gonostylus (Figs. 119, 120).

Two largely membranous lobes lie between and above the gonocoxites. The more dorsal lobe extends posteriorly from the entire rear margin of the ninth tergite. From its location I would interpret it as the **proctiger** (Crampton, 1942: 86, Fig. 11B; van Emden and Hennig, 1970: 131) (Fig. 131), that is, the remnants of the tenth and eleventh abdominal segments. Saether (1969: 28) terms it the "caudal lobe of tergite IX." If

an anal point is present, it lies dorsal to the proctiger. The proctiger is strictly membranous, bears numerous fine microtrichia, and may, in unfavorable slide mounts, be occasionally compressed and folded beneath the ninth tergite.

Immediately ventral to the proctiger, and usually hidden or somewhat obscured by it, is the intromittant organ. According to Smith (1969: Figs. 3D, 4B, D), the intromittant organ in pterygotes has been formed by the fusion of the gonapophyses (possibly endites) of gonocoxite IX. Simple dissection of alcohol material shows that the intromittant organ in *Diamesa* is a weak, membranous lobe bearing two dorsal sclerotized members which articulate anteriorly with the sternapodeme and converge posteriorly to nearly touch each other (Figs. 26, 126). According to van Emden and Hennig (1970) and others, these structures are the parameres, a usage followed by Brundin (1966). Reiss (1968) calls them the "obere Platte des Penisscheiden ("Paramere")," Schlee (1968) calls them the "Hakenspange," while Saether (1971) seems to call them the **aedeagal lobes.** They apparently are the dorsal rami in Smith's (1969) terminology. Each aedeagal lobe is produced into the cavity of the gonocoxite near the articulation of the aedeagal lobe to the sternapodeme, forming a strong apodeme, the **phallapodeme** (Saether, 1971) (Fig. 126). The aedeagal lobes often have poorly delimited borders, particularly posterolaterally, and are thus difficult to show in all drawings.

The main surface of the intromittant organ is a fine, clear membrane which is invisible in slide mounts but is fairly easily seen in dissections. Dorsally it extends from the antero-medial margin of the aedeagal lobes to the rear margin of the sternapodeme (Fig. 26). Laterally and ventrally it apparently runs from the postero-lateral margins of the aedeagal lobes to the medial margin of the proximal foramen of the gonocoxite and to the basal wedge.

Systematic Treatment

Genus DIAMESA

The genus *Diamesa* is keyed in Brundin (1956) and Serra-Tosio (1968). The following diagnosis is in part after Serra-Tosio (1971).

Diagnosis, adult ♂. — Antenna plumose, with 13 flagellomeres, or with varying reduction in plumosity and loss of flagellomeres to a non-plumose condition with 8 flagellomeres. AR usually less than 2, occasionally up to 2.8. Scape only rarely with setae, pedicel usually with 1-3 setae ventro-medially. Eyes not produced bridge-like dorsally, dorso-medial corner truncate or rounded, without or with only weak to moderate dorsal ocular apodeme; eyes hairy or bare. Postocular setae uniserial, outer vertical setae usually distinguishable from inner vertical setae, inner vertical

setae usually fairly numerous, extending half or more of distance from dorso-medial margin of eye to midline of vertex; interocular setae usually distinguishable from inner vertical setae. Clypeal setae present. Palpus 5-segmented, with a distinct sunken organ on third palpal segment. Antepronotal sclerites with setae only laterally, usually with small medial notch. Scutum with dorso-central setae uniserial (occasionally staggered posteriorly), only exceptionally with a few acrostichal setae; prealar setae confined to a group on postero-dorsal region of prealar callus. Wings with microtrichia visible as minute points at about 100×, usually visible as seta-like projections at 600×; wings without setae on membrane; anal lobe usually slightly acute; setae present dorsally on R, R_1, and R_{4+5}; r-m slightly to moderately arched; apparent m-cu present; distance from apparent fCu to apparent m-cu less than length of apparent m-cu. Fourth tarsomere shorter than fifth, more or less cordiform; Ti III with a comb of spines in a fairly regular single row. Hypopygium usually with an anal point; gonocoxite with a slight to well-developed basal plate, often with a medial field; basal wedge present; intromittant organ with only dorso-lateral regions sclerotized (forming the aedeagal lobes) and with moderate phallapodemes; gonostylus usually with subterminal peg.

Key to the Nearctic Species of Diamesa, Adult Males

1. Antenna plumose, with 13 flagellomeres (Fig. 36) 2

1'. Antenna not plumose, usually with 8 (1 species with 10-11) flagellomeres (Figs. 40, 41, 43) 25

2 (1). Eyes hairy, i.e., length of eye microtrichia about 1.5 or more times the height of ommatidial lenses and visible along lateral eye margin when head is viewed from front (Fig. 48) 3

2'. Eyes not hairy, i.e., eye microtrichia not visible or at least not surpassing height of ommatidial lenses along lateral eye margin when head is viewed from front (Fig. 51) 13

3 (2). Basimedial setal cluster present, usually located just ventrad to basal plate (Fig. 128), occasionally just distad to basal plate (Fig. 115) or just below medial field (Fig. 113) 4

3'. Basimedial setal cluster absent 12

4 (3). Basimedial setal cluster immediately below mid-region of medial field; gonostylus fairly slender, widest at about 0.3 its length; medial field with medial surface flat and vertical, giving appearance of strong medial border; distal 0.2 of medial field free; anal point short (Fig. 113) .... *D. heteropus*

4'. Basimedial setal cluster located more proximad, either ventrad or just ventro-distad to basal plate 5

5 (4'). Gonocoxite very long, slender, with basimedial setal cluster at end of or just distad to weak basal plate; setae in basimedial cluster about 12-15, directed slightly anteriad and not reaching much beyond mid-line of hypopygium; medial field elongated, with numerous long, anteriorly-directed setae on distal 0.4 (Fig. 115) .... *D. bohemani*

5'. Gonocoxite not unusually long and slender; basimedial setal cluster located below basal plate; medial field not elongate, without numerous anteriorly-directed setae 6

6 (5′). Gonostylus triangular, very broad distally, i.e., postero-distal region expanded and forming a corner (Fig. 129) .... *D. nivoriunda*

6′. Gonostylus not triangular 7

7 (6′). Gonostylus broadest at about 0.6 its length, somewhat recurved, with disto-dorsal ridge (Fig. 130) .... *D. mendotae*

7′. Gonostylus straighter, without disto-dorsal ridge 8

8 (7′). Basimedial setal cluster with 10 or fewer setae, cluster just below distal end of basal plate; medial field with wide, free distal end curving mesad slightly (Fig. 126) .... *D. chiobates*

8′. Basimedial setal cluster with over 15 setae, cluster below basal plate; medial field variable 9

9 (8′). Medial field expanded medially, distal 0.3-0.4 of medial field free and directed posteriad; gonostylus fairly broad (Fig. 131) .... *D. cheimatophila*

9′. Medial field not particularly broad and expanded, distal 0.2 free and curving mesad slightly; gonostylus more slender 10

10. Basal plate inconspicuous or absent (Fig. 114) .... *D. haydaki*

10′. Basal plate fairly strong, with numerous short, stout microtrichia ventrally 11

11 (10′). Basal plate produced disto-medially; several fairly long, very strong setae on an ill-defined mound below medial field; gonostylus slender (Fig. 125); western species .... *D. ancysta*

11′. Basal plate not produced disto-medially; strong setae below medial field not on a particular mound; gonostylus stronger (Fig. 127); eastern species .... *D. vockerothi*

12 (3′). Gonostylus very long, about 0.7 times length of gonocoxite; medial field long, slender, with 1-3 long mesad-directed setae at about 0.5 its length and about 3 long setae at distal end; distal 0.4 of medial field free (Fig. 138) .... *D. insignipes*

12′. Gonostylus shorter; medial field expanded medially, with stout setae ventro-medially (Fig. 123) .... *D. bertrami*

13 (2′). Gonostylus forked; anal point short, very broad (Fig. 124) .... *D. geminata*

13′. Gonostylus not forked; anal point slender or absent 14

14 (13′). Gonocoxite distally with very strong dorso-medial projection (Fig. 135) .... *D. sommermani*

14′. Gonocoxite without distal projection 15

15 (14′). Gonocoxite with a small, dorso-medial, setous, finger-like projection and a stronger, medial spine- and seta-bearing projection just distad to basal foramen (Fig. 137); small species (L_{tot} 3.0-3.7) .... *D. lindrothi*

15′. Gonocoxite without such projections; size larger 16

16 (15′). Anal point absent; Tg IX very weak medially, appearing to be formed of two separate sclerites (Fig. 110) .... *D. incallida*

16′. Anal point present; Tg IX only slightly (*D. simplex, aberrata*) or not at all weakened medially 17

17 (16′). Medial field with basal 0.7 expanded mesad, with distal 0.2 free and tapering posteriorly; aedeagal lobes with fringe of fine setae (microtrichia?) along distolateral border (Fig. 123) .... *D. chorea*

17′. Medial field without medially-expanded basal region; aedeagal lobes without fringe disto-laterally 18

18 (17′). Medial field at most only weakly differentiated, without sharply delimited dorsal border; distal end of medial field may be expanded mesad slightly, but not free and not extending posteriad; without or with only weak apodemes on underside of Tg IX 19

18′. Medial field well developed, with sharply delimited dorsal border; distal end of medial field free, extending posteriad or postero-mesad 20

19 (18). Medial field only very weakly differentiated, without sharp dorsal margin and without expanded distal end; gonostylus (when properly oriented) fairly sharply narrowed basally; anal point moderate, not quite or just reaching distal ends of aedeagal lobes (Fig. 111) .... *D. simplex*

19′. Medial field slightly better developed, with slightly expanded distal end; gonostylus fairly slender, straight, of nearly equal width throughout; anal point short to moderate, shorter than length of Tg IX (Fig. 112) .... *D. aberrata*

20 (18′). Disto-dorsal end of medial field well-sclerotized, flap-like, projecting dorso-mesad; gonostylus fairly slender, somewhat recurved, of fairly equal length throughout (Fig. 139) .... *D. gregsoni*

20′. Medial field without well-sclerotized, disto-dorsal, flap-like projection; gonostylus usually distinctly broadened basally 21

21 (20′). Apical 0.3 of gonostylus sharply narrowed, tapering (Fig. 132) .... *D. garretti*

21′. Gonostylus otherwise 22

22 (21′). Gonostylus "clubbed," i.e., distal 0.5 expanded (Fig. 121) .... *D. clavata*

22′. Gonostylus not enlarged distally 23

23 (22′). Apical 0.2 of medial field free, directed posteriad, with numerous microtrichia and with setae directed slightly antero-mesad; proximo-dorsal region of medial field without microtrichia; about 8 fairly long setae at proximo-dorsal corner of medial field; gonostylus tapering fairly evenly (Fig. 122) .... *D. colenae*

23′. Apical 0.2 of medial field free, directed postero-mesad; proximo-dorsal region of medial field with microtrichia; setae and microtrichia distributed evenly over medial field; gonostylus broadest basally 24

24 (23′). Gonostylus long, with apical 0.5-0.6 slender (Fig. 134) .... *D. arctica*

24′. Gonostylus shorter, with apical 0.4-0.5 slightly tapering distally (Fig. 133) .... *D. spinacies*

25 (1′). Antenna with 10-11 flagellomeres (Fig. 40); legs extremely long, $L_{p_{I}}:L_{tot}$ about 1.7; gonostylus directed posteriad or postero-mesad, not folded forward; gonostylus disto-dorsally with flat, microtrichia-covered field (Fig. 136) .... *D. nivicavernicola*

25′. Antenna with 8 flagellomeres (Figs. 41, 43); legs shorter, $L_{p_{I}}:L_{tot}$ about 1.5; gonostylus not as above 26

26 (25′). Medial field with distal 0.2 free; gonostylus broadest basally, distal 0.5 narrowed; anal point fairly long, directed posteriad (Fig. 140) .... *D. coquilletti*

26′. Medial field weak, without free distal end; gonostylus and anal point usually otherwise 27

27 (26′). Gonostylus with 3 or more apical tooth-like serrations; medial surface of gonostylus without "pile" of microtrichia 28

27′. Gonostylus without apical teeth; medial surface of gonostylus with "pile" of microtrichia 29

28 (27). St IX with very long postero-dorsal extensions projecting along gonocoxite; gonostylus broad basally, sharply narrowed at about 0.5 its length, with fairly broad distal end (Fig. 119) .... *D. amplexivirilia*

28′(27′). St IX with short postero-dorsal extensions; gonostylus broad basally, tapering fairly evenly towards apex (Fig. 120) .... *D. davisi*

29 (27′). Anal point short, weak, directed ventrad (Figs. 116, 117); large species (L_{tot} 3.9-5.3 mm) .... *D. leona*

29′. Anal point fairly strong, broad basally, well sclerotized, directed posteriad (Fig. 118); smaller species (L_{tot} 3.1-4.1) .... *D. leoniella*

Synonymies and Descriptions

Long synonymies, attempting to cite every occurrence of a name in the world literature, seem unnecessary, and synonymies here are not meant to include every published reference to a specific name. Omitted are entries in lists of species compiled from the literature, references in which the author had no specimens but included a name in a key or discussion using characters from the literature, and entries in catalogues (unless the name is a new combination or new name or new locality records are given).

The following descriptions are fairly long. Actually, I don't feel that all chironomid descriptions should be this detailed. On the other hand, many descriptions have been based on superficial characters and are too incomplete to permit an accurate identification. Furthermore, many characters important in a phylogenetic classification have been overlooked. Except for coloration, I have simply described these species of *Diamesa* as thoroughly as I can, without trying to omit "unimportant" characters. I feel that when we have looked at more characters in the entire family we will be able to better form a sound phylogenetic classification.

In reading these descriptions, one must note the phrase "as in *D. mendotae* [or *amplexivirilia,* etc.] except:". This means that everything in the description of *mendotae* (or *amplexivirilia*, etc.) also applies to the description of species "A", except as stated in the description of species "A". For example, the description of the antenna of *D. ancysta* says nothing of the number of flagellomeres or whether the antenna is plumose or not. Reading the description of *D. mendotae,* however, we see "Figs. 36, 37, 39. 13 flagellomeres, plumose;". The antenna of *ancysta,* therefore, has 13 flagellomeres and is plumose, as in Figs. 36, 37, and 39. The

next phrase, "longest flagellar setae . . .", in the description of *mendotae,* is the first phrase in the antennal description of *ancysta,* indicating that the longest flagellar setae in *ancysta* are slightly different from those in *mendotae.* One simply reads each phrase between semicolons in the description of *mendotae.* If the phrase is not in the description of species "A", then the character in species "A" is essentially as described in *D. mendotae.* This merely avoids repeating "13 flagellomeres, plumose" and numerous other phrases some 20 or more times.

Unless stated otherwise in the descriptions, all measurements are in microns. The first figure given is the mean; the pair of numbers in parentheses is the range.

Diamesa aberrata Lundbeck

D. Waltlii Meigen. Staeger, 1845: 353-354 (recorded from Greenland; misdetermination).

D. aberrata Lundbeck, 1898: 289-291 (described from 4 males from Greenland); Edwards, 1923: 235, 237-238 (records female, pupa, and damaged male from Jan Mayen Island; determination somewhat questionable); Edwards, 1933: 616, 618 (figures hypopygium of co-type); Edwards, 1935: 471 (in part) (records from Jameson Land, East Greenland); Pagast, 1947: 471-472, 520-521 (description of adult and pupa); Wuelker, 1959: 345-348 (adult description, figure of hypopygium, comparison of pupa with that of *D. incallida* (Walker), description of larva); Oliver, 1962: 4-5 (designation of lectotype; description, figure of hypopygium); Serra-Tosio, 1964: 32-34 (discussion of pupal characters; records of adults in France); Serra-Tosio, 1966: 127 (records from "le Massif Central (Vivarais)," France); Serra-Tosio, 1967d: 98, 101 (predation on larvae by Simuliidae); Saether, 1968: 455 (records 9 males from Finse area, Norway); Serra-Tosio, 1969a: 205-206 (records specimens from Brundin collection from Norway and Sweden); Serra-Tosio, 1970d: 121 (records female pupa from France); Serra-Tosio, 1970c: 25 (records 4 pupal exuviae, 2 males from southern Spain); Serra-Tosio, 1971: 129-137, Figs. 43-47 (description of male and female adults, pupa; distribution; ecology).

[*non*] *D. aberrata* Lundbeck. Andersen, 1937: 80-82 (misdetermination of *D. simplex* Kieffer).

Description (unless otherwise stated, n = 5 and measurements are in microns): as in *D. mendotae* except:

TOTAL LENGTH. — 5.3 (4.9-6.1) mm.

COLORATION. — not noted before slide mounting.

ANTENNA (n = 4). — longest flagellar seta 0.56 (0.49-0.70) L_{fl}; Flm_{13} with apical 0.19-0.24 spindle-shaped, mainly swollen ventrally; 1-2 short, slender setae dorso- and ventro-medially on Flm_1; long (MaxL 594-859) flagellar setae 0-1 on Flm_1, 2-3 on Flm_2, 5-8 on Flm_3, increasing to about 13 on Flm_{12}, numerous on Flm_{13}; 1 or occasionally 2 smaller, blunt sensilla basiconica ventrally on Flm_1, 1 ventrally on $Flm_{2\ \&\ 3}$; 1 or occasionally 2 ringed sensilla coeloconica dorsally, 1 ventrally on Flm_1, 1 dorsally on Flm_2; $\overline{L}_{flm_{1-13}}:\overline{W}_{flm_{1-13}}$ 101:54, 23:48, 28:46, 29:43, 31:43,

32:44, 36:44, 38:44, 42:43, 43:41, 44:39, 45:39, 779:37; AR 1.45 (1.30-1.72) (n = 5); 1 preapical antennal seta; L_{pas} 37 (27-49); D_{pd} 180 (166-198); 2 (rarely 3) pedicellar setae ventro-medially; H_{sc} 192 (174-212).

HEAD. — W_h 659 (604-707); dorsal ocular apodeme weak to moderate; IOS/side 3-4; 1-2 medial vertex setae occasionally present; PtOS/side 10-13; inner verticals reaching to 0.53-0.69 of distance from dorso-medial margin of eye to midline of vertex. Clypeus slightly swollen anteriorly, as long as or longer than wide. Eyes not hairy, microtrichia visible as minute points antero-medially, not visible laterally; H_e 301 (284-322). $\overline{L_{ps}}_{2\text{-}5}:\overline{W_{ps}}_{2\text{-}5}:\overline{MaxL_{pss}}_{2\text{-}5}$ 103:38:88, 177:42:67, 157:35:63, 255:31:32. D_{so} 15 (14-16); CP 0.94 (0.90-0.98); palpal stoutness 4.81 (4.48-5.34).

THORAX. — L_{th} 1.29 (1.02-1.44) mm, D_{th} 1.30 (1.16-1.41) mm. Antepronotum with medial commissure strong, not quite reaching rear margin of phragma I, reaching to or slightly surpassing scutal process; antepronotal notch weak, acute to slightly obtuse, medial corners rounded; LAS/side 7 (5-11); dorsocentrals uniserial to staggered posteriorly; DCS/side 10 (7-17), $MaxL_{dcs}$ 142-166 (n = 3); PAS/side 9 (6-11); scutellar setae roughly in 2 irregular rows; ScS about 18-22, $MaxL_{scs}$ 139 (105-176); ASR 0.63 (0.62-0.65); 1-3 fine setae on epimeral II protuberance.

WING. — L_w 3.5 (3.2-3.7) mm, W_w 1.08 (1.02-1.19) mm. Dry wing not available. Slide mounted wing showing: costal projection 94 (79-129) (n = 4) or 5.5 (4.0-7.2) times its width; base of r-m distal to apparent m-cu by 2-4 times width of r-m; apparent m-cu distal to apparent fCu by 2-6 times width of apparent m-cu; VR 0.90 (0.86-0.92). Remigium with 1 strong seta on hand, 0(?)-2 weak setae and about 8-15 campaniform sensilla just beyond wrist, and 2-4 setae and 4 large and about 10 smaller campaniform sensilla on distal 0.5 of forearm. Setae 17 (14-19) on R, 12 (9-14) on R_1, 3 (2-4) on R_{4+5} (uniserial and dorsal on all). Campaniform sensilla 3 or 4 ventrally on Sc just distad to arculus, 2 dorsally on R_1, 1 dorsally and 1 ventrally (or rarely 1 dorsally with 1 ventral seta) near base of R_{2+3}, and 1 or 2 dorsally on R_{4+5}. Squama with 29-47 (n = 4) strong setae, $MaxL_{sqs}$ 119-202 (n = 4).

	Fe	Ti	Tm_1	$Tm_{2\text{-}5}$	LR	BV	SV
P_I	1440 (1260–1610)	1680 (1510–1860)	1200 (1060–1380)	1230 (1140–1340)	0.72 (0.70–0.74)	3.51 (3.35–3.68)	2.47 (2.01–2.62)
P_{II}	1630 (1430–1790)	1600 (1460–1700)	840 (790–900)	970 (910–1060)	0.53 (0.47–0.57)	4.22 (3.95–4.84)	3.85 (3.49–4.33)
P_{III}	1820 (1610–2030)	1910 (1700–2060)	1320 (1160–1460)	1210 (1140–1340)	0.69 (0.66–0.71)	4.02 (3.91–4.29)	2.84 (2.75–3.02)

LEGS. — $\overline{L_p}_{I}:\overline{L_{tot}}$ 1.05. Fe I usually with sparse postero-dorsal beard of about 4-7 long setae. Apical spur of Ti I long, slender, with small, sparse prickles on basal 0.3-0.5; L_{tispI} 89 (85-98); apical spurs of Ti II stouter, subequal to nearly equal in length, with numerous prickles on basal 0.5; L_{tispII} 64 (56-73); $L_{atispIII}$ 67 (56-78), $L_{ptispIII}$ 94 (81-105). Weak polygon pattern occasionally visible near apex of Ti I.

Ti III with posterior comb of about 15-18 spines arranged in a fairly regular single row. Spiniform setae on first 3 tarsomeres of P I-III as follows: 2 (apical), 2 (apical), 0; 6-13, 2 (apical)-3, 0-1 (apical); 10-13, 4-7, 0. Lengths and ratios of leg segments, p. 51.

Hypopygium (without reference to *D. mendotae*). — Fig. 112. Tg IX with 12 (8-20) setae/side. Anal point short, shorter than Tg IX, rarely with apical peg; apodemes not present on underside of Tg IX. L_{gnex} 283 (276-290), $\overline{L}_{tot}$:$\overline{L}_{gnex}$ 19. Basal plate scarcely developed, margin obtuse to about right-angled disto-medially, with microtrichia ventrally. Medial field weakly to fairly well delimited dorsally, weakly sclerotized, with numerous microtrichia and setae, setae particularly strong antero-ventrally; distal end of medial field not or only very slightly free. Gonostylus slender, roughly of equal width, with subterminal peg and short terminal ridge. Sternapodeme a simple, slender arch. Basal wedge short but well developed, slightly rugose.

Diagnosis. — Antenna plumose, eyes not hairy; anal point present but short; gonostylus slender. *D. incallida* lacks an anal point, has a broader gonostylus, and has a more sharply delimited medial field. *D. simplex* has a longer anal point and its gonostylus is broader distally and narrows sharply proximally.

Material examined. — *Alaska,* Kenai Pen., 17 June 1965, Jeep trap 65-2, 9:10-10:50 PM, Primrose Seward and back, K. M. Sommerman, 1 male (USNM); *Alaska,* Palmer, 23 Sept. 1964, K. M. Sommerman, Jeep trap, 12 males (USNM); *Greenland,* "Godthaab, Möller, Type", 1 male (Copenhagen); "Grönland, M[?]us. [??]og. ♂" (handwritten label partially indecipherable), 1 male (Copenhagen); *East Greenland,* Cape Dalton, 20-viii-1933, D. Lack and G. C. Bertram, 1 male (BM(NH)); *East Greenland,* Jameson Land, 4-14. viii.1933, D. Lack. BM. 1934-233, 1 male (BM (NH)); *Iceland,* 2.5 km. W. Grimssatadir, 4.vii.1962, B. V. Peterson, E. Bond, Det. 225, L. F. 28.1.1963 DRO. 9.9-3, 1 male (CNC); *Jan Mayen Isle,* O. U. Jan Mayen Isle expedition. 8.viii.1947, living rooms; coll. A. Mac Fayden 63.1947, 1 male (BM(NH)); *Wyoming,* 44°10'N, 107°05'W, Powder River Pass, 18 mi. W, 13 mi. S of Buffalo, alt. 9,600', sweeping in spruce-fir forest 26 Aug. 1967, 27 Aug. 1968, leg. D. Hansen, 3 males (UMn).

Discussion. — Lundbeck (1898: 289-291) described *aberrata* from four specimens: "Godthaab two examples (Møller), two examples from older times without a specific locality" (translated). Lundbeck (l.c.) also states that Staeger (1845) had recorded *aberrata* from Greenland as *D. Waltlii.* Dr. S. L. Tuxen kindly loaned me the lectotype designated by Oliver (1962) and a specimen from Greenland apparently seen by Staeger and presumably recorded by him as *Waltlii.* I cleared the hypopygium of this latter specimen and confirmed that it was, indeed, *aberrata,* as Lundbeck (1898) stated. Lundbeck's description was too incomplete to permit a specific determination, and the species was unidentifiable until Edwards (1933) figured the hypopygium of one of Lundbeck's specimens and

noted other characters. Two years later, Edwards (1935) recorded four specimens of *aberrata* from Jameson Land, East Greenland. A. M. Hutson at the British Museum (Natural History) kindly loaned me these four specimens, and I was surprised to find that the series consisted of three species: one specimen was *aberrata,* one was *chorea,* and two were *simplex.*

Andersen's (1937) hypopygial figure shows that he was actually seeing *D. simplex* (compare Andersen, 1937: Fig. 56 and my Fig. 111a).

Serra-Tosio (1971: Pl. 45, Figs. 6-20) notes the extreme variation in the length of the anal point in specimens from Europe. While I have fewer specimens than Serra-Tosio examined, I do find a similar variation in anal point length in nearctic material.

The few specimens I collected in Wyoming show no particular differences from those from Alaska, Greenland, or Iceland.

LOCATION OF TYPES. — Lectotype (and the other three specimens of of the series?) at the Zoologiske Museum, Copenhagen.

Diamesa amplexivirilia [4] new species

Description (unless otherwise stated, n = 5 and measurements are in microns):

TOTAL LENGTH. — 3.5 (3.3-3.7) mm (n = 4).

COLORATION (pinned specimens). — flagellum gray-brown, pedicel and basal 0.5 of Flm_1 light brown; head and thorax gray, pruinose; lateral scutal stripes dark gray; trochanters, proximal 0.05 of femora yellow-brown, rest of legs brown; shaft and capitellum of haltere pale, base becoming light brown; abdomen and hypopygium dark brownish gray.

ANTENNA. — Figs. 43, 45. 8 flagellomeres, rarely with partial fusion of $Flm_{7\ \&\ 8}$ or $Flm_{1\ \&\ 2}$; non-plumose, longest flagellar seta (on $Flm_{7\ or\ 8}$) 0.19 (0.17-0.21)L_{fl}; Flm_1 with basal 0.2 tapering proximally, without distinct basal nipple, rest roughly cylindrical, often slightly constricted at midregion or just slightly swollen distally; Flm_{2-5} irregularly fusiform, Flm_{6-7} distinctly fusiform; Flm_8 roughly cylindrical or slightly fusiform in basal 0.4-0.6, tapering beyond to blunt apex; flagellar setae short (MaxL 76-93), setae 2-6 on Flm_1, 2-3 on Flm_2, 1-4 on Flm_3, 0 or occasionally 1 on $Flm_{4\ \&\ 5}$, 0-2 on Flm_6, 2-6 on Flm_7, 2-3 on Flm_8; setae basically in single irregular whorl/flagellomere; setal whorl at 0.6-0.8 of Flm_1, near 0.5 of Flm_{2-7}, at 0.1 of Flm_8; antennal furrow absent; all Flm's with long microtrichia. Antennal sensilla as follows: large, blunt sensillum basiconicum 1 on Flm_{1-5}; slightly smaller, blunt sensilla basiconica 0-1 on Flm_1, 2-4 on Flm_2, 2-6 on Flm_3, 4-6 on Flm_4, 2-5 on Flm_5, 3-6 on Flm_6, 1-6 on Flm_7, 0 on Flm_8; long, pointed sensilla basiconica 1-4 on Flm_6, 8-11 on Flm_7, numerous on Flm_8; ringed sensilla coeloconica 1-2 on Flm_1, 1 on Flm_2, 4-7 on Flm_8; small sensilla coeloconica 1-2 on Flm_1, 1 on Flm_{2-3}, 1-3 near apex of Flm_8. $\overline{L}_{\underset{1-8}{flm}} : \overline{W}_{\underset{1-8}{flm}}$ 104:35, 45:33, 40:31, 28:29, 27:31, 24:32, 34:40, 125:45; AR 0.38

[4] From *amplector, -exus* (L.), enfold or embrace, and *virilia* (L.), male genitalia (Brown, 1954). The name refers to the posterior extensions of the ninth sternite, which extend along the sides of the hypopygium and appear something like hands holding or embracing it (Fig. 119).

(0.31-0.46); 2 apically curved preapical antennal setae; L_{pas} 26 (24-29); pedicel roughly globose, with microtrichia; D_{pd} 68 (63-76); 1-3 pedicellar setae; 1 campaniform sensillum dorsally at ridge of indentation for Flm_1; scape quite small, with distinct articulation to pedicel ventro-medially and weak articulation to antennifer ventro-laterally; H_{sc} 63 (59-69); scape with microtrichia but without setae; scape well sclerotized all around.

HEAD. — Fig. 53. W_h 445 (435-464); coronal suture strong, ending between tops of antennal sockets and lower ends of vertex projections over scapes, bifurcating on dorsal region of vertex, with strong internal apodeme; coronal triangle short, barely visible anteriorly; vertex not sunken at arms of coronal suture; coronal triangle with usual 4 short setae in large sockets; rear margin of vertex produced dorsad at midline to form small, clear, triangular nape; vertex medially produced toward and broadly fusing with frons, forming broad, fairly well sclerotized region between antennal scapes; vertex fairly strongly projecting over dorso-medial region of each scape; reduced ocelli very far apart, about at level of tops of antennal sockets; dorsal ocular apodeme absent; interantennal bar absent; frons poorly or not at all delimited from antennal sockets; epistomal suture strong to moderate medially, strong to absent laterally; interocular setae usually distinguishable from inner vertical setae, but occasionally merging with them, in dispersed group centered 0.5-0.7 of distance from dorso-medial margin of eye to midline of vertex; IOS/side 6 (2-9); postocular setae in uniserial row running just behind rear margin of eye from near postero-ventral eye margin to merge with slightly longer, stronger outer verticals; PtOS/side 4-8; inner and outer verticals not well differentiated, the more medial inner verticals becoming more curved and decumbent, dispersed on dorsal region of vertex and just dorsomesad to dorso-medial corner of eye; inner verticals not or only occasionally occurring below dorsal margin of eye anteriorly, reaching to 0.53 (0.40-0.69) of distance from dorso-medial margin of eye to midline of vertex; medial vertex setae absent; slight vertex hump occasionally present behind eyes. Clypeus distinctly wider than long, sides converging ventrally, rounded, ventral margin rounded; clypeal setae in 2 dorso-lateral groups; CS 5 (2-9). Tentorium not or only very slightly swollen antero-laterally at base, but with moderate postero-medial basal plate-like projection; tentorium not extending beyond PTP. Eyes reniform; eyes strongly hairy, microtrichia about twice the height of ommatidial lens; eyes with dorso-medial margin broadly rounded; dorso-medial margin not extending as far mesad as ventro-medial margin; H_e 213 (208-218); ventral ocular apodeme very weak; antero-ventral margin of eye contacting tentorium; antennifer weak. Palpus 5-segmented; PS_1 without setae, roughly subglobose, nearly or as well sclerotized as other palpal segments; PS_2 broadest distally, PS_3 distinctly fusiform, PS_4 cylindrical or slightly fusiform, PS_5 approximately cylindrical; $\overline{L}_{ps_{2\text{-}5}} : \overline{W}_{ps_{2\text{-}5}} : \overline{MaxL}_{pss_{2\text{-}5}}$ 64:38:52, 111:46:49, 92:38:36, 141:28:25; sunken organ roughly hemispherical, prominent, at 0.7 of PS_3; D_{so} 18 (16-20); all palpal segments with grouped microtrichia; CP 1:08 (1.00-1.16); palpal stoutness 2.70 (2.47-2.89). Cibarial plate about as high as or slightly higher than wide, sides slightly concave, cornua fairly long, slender, slightly arched.

THORAX. — similar to *D. leoniella*, Fig. 86. L_{th} 1.07 (1.04-1.11) mm (n = 4), D_{th} 0.96 (0.94-1.00) mm (n = 4). All thoracic sclerites covered with fine microtrichia. Antepronotum with short but fairly strong medial commissure which extends only about 0.4 of distance to rear margin of phragma I and is slightly surpassed by anterior margin of scutum; antepronotal notch small, acute; medial corners

rounded, scarcely or not surpassing anterior margin of scutum; anterior margin of antepronotal halves nearly straight or slightly arched medially, giving the antepronotum something of a truncate appearance, anterior margin arching back and then becoming concave antero-laterally; lateral antepronotal setae somewhat dispersed medially, roughly on ventro-lateral and antero-lateral margin, region of lateral setae strongly swollen; LAS/side 7 (4-11). Postpronotum fused with scutum antero-dorsally and with anteanepisternum II ventrally, delimited from scutum postero-dorsally; postpronotum without setae, but with 2-3 faint to clear postpronotal sensilla (?) antero-dorsally; postpronotal apophyseal pit small to nearly absent, postpronotal apophyses absent. Scutum in side view somewhat flattened, not or only slightly indented above parapsidal suture, extending as far as or surpassing fore margin of antepronotum; scutal process absent. Dorsocentral setae uniserial or just slightly staggered; a few tiny, clear dots (sensilla?) present in or just beside DCS row; DCS/side 9 (7-10), $MaxL_{dcs}$ 95-120; acrostichals absent. Prealar setae in elongate group or, if few, in staggered row, confined to postero-dorsal region of prealar callus; PAS/side 5 (3-8); supraalar setae absent; scutal angle moderate, rounded; parapsidal suture arched, with internal apodeme; humeral scar a tuberose oval just anterior to dorsal 0.3 of parapsidal suture; medial scutal scar running as a faint, narrow band from the anterior-most point of scutum to about the midpoint of scutum, there expanding to form broader, pale scar which narrows and disappears at about the ends of dorsocentral setae rows. Scutellar setae dispersed or very roughly in 3-4 rows; ScS 33 (23-48) (n = 4), $MaxL_{scs}$ 99 (81-115). Medial cleft of postnotum reaching about 0.3 of length of postnotum; postnotum with suture on midline posteriorly and with rounded postero-dorsal margin. Anteanepisternal pit small, ventral border less well defined than dorsal border; medioanepisternum II ranging from completely delimited ventrally, with round ventral margin, to partially fusing with postanepisternum II and with more pointed ventral margin; anapleural suture strong; ASR 0.52 (0.49-0.54); 0-8 setae on epimeral II protuberance, which is fairly well developed; 0-1 seta on epimeron II just below protuberance; no other setae on any other pleural sclerite.

WING. — L_w 2.76 (2.57-2.97) mm, W_w 0.98 (0.93-1.07) mm. Outline as in Fig. 99. Wing margin usually slightly concave at about 0.7 of R_1 and just before M_{3+4}, straight or slightly concave distal to anal lobe; anal lobe slightly obtuse. Dry wing showing: wing folds about as in *D. mendotae*, except that vestige of ?M_3 weak and not running to wing margin and little or no fold present between M_{3+4} and Cu_1. Slide mounted wing showing: microtrichia visible as numerous, close points at 150×, seta-like projections not clearly discernable even at 650× except on or very near veins where wing surface is nearly vertical. Membrane without setae. Marginal setal fringe in 2 rows along proximal 0.2 of C, becoming more or less in 3 rows on distal 0.8 of C, then becoming alternating long-short past distal end of costa, longest on anal lobe. Costa becoming easily discernable just before humeral cross vein, distal 0.8 slightly wider than proximal 0.2, widest along distal 0.6 of R_1; costa ending moderately before tip of wing, at or slightly before level of end of M_{1+2}; costal projection 44 (24-63) or 1.9 (1.0-2.8) times its width; Sc appearing as sharp fold proximally, becoming very weak at or well before forking of R, ending before C. Distal 0.6 of R_1 closely appressed and somewhat diffusely fusing with C, usually slightly enlarged. R_{2+3} fairly strong only at base, fading beyond about 0.2-0.4 its length, scarcely visible distally; R_{2+3} running at first somewhat closer to R_{4+5} than to R_1,

ending just beyond end of R_1; R_{4+5} strong, ending slightly before end of M_{1+2}. r-m strong, slightly arched; base of r-m anywhere from directly over apparent m-cu to distal to apparent m-cu by width of r-m. M a mere trachea proximally, gradually becoming stronger towards apparent m-cu; M_{1+2} fairly weak; vestige of ?R_5 easily visible as diffuse band just anterior to distal 0.3 of M_{1+2}; vestige of ?M_2 easily visible as diffuse band just posterior to distal 0.6 of M_{1+2}; apparent m-cu little more than a trachea, approximately perpendicular to M and Cu; apparent m-cu ranging from proximal to apparent fCu by width of apparent m-cu to distal to apparent fCu by 2 times width of apparent m-cu; VR 0.95 (0.92-0.98); M_{3+4} fairly strong; Cu strong, with prominent trachea visible to apparent m-cu; distal 0.5 of Cu_1 curving gently posteriorly. An fairly weak, fading before wing margin. Remigium with 1 strong seta on hand, 0-2 weak setae and about 8-12 campaniform sensilla just beyond wrist, and 2-4 setae and about 3 large and 6-8 smaller campaniform sensilla on distal 0.5 of forearm. Setae 8 (6-9) on R, 9 (8-11) on R_1, and 5 (2-9) on R_{4+5} (uniserial and dorsal on all). Campaniform sensilla 1-2 ventrally on Sc just beyond arculus, 2-4 dorsally on R_1, 1 (occasionally 0) dorsally near base of R_{2+3}, and 2-3 dorsally on R_{4+5}. Squama with 21 (15-27) setae, $MaxL_{sqs}$ 90 (75-95); alula bare.

LEGS. — Legs very long, slender; $\overline{L}_{p_I}:\overline{L}_{tot}$ 1.58; Fe I without beard, longest seta on any femur shorter than width of that segment. Apical spur of Ti I rather short, slightly expanded basally, with somewhat sparse prickles on basal 0.4-0.5; L_{tispI} 41 (36-48); apical spurs of Ti II slightly stouter, subequal in length, with fairly numerous prickles on basal 0.6-0.7; L_{tispII} 36-48; apical spurs of Ti III with numerous prickles on basal 0.5-0.7; $L_{atispIII}$ 40-50, $L_{ptispIII}$ 69-76; all apical tibial spurs with oval mark (sensory pit or dome?) on basal 0.2-0.4. Weak polygon pattern not visible near apex of Ti I; polygon pattern on Ti III very well developed and extensive. Ti III with posterior comb of about 17-20 spines arranged in a fairly regular single row. Posterior surface of Ti III with setae but without stout spines. Spiniform setae on first 3 tarsomeres of P I-III as follows: 2 (apical), 2 (apical), 2 (apical); 9-13, 3-5, 3; 15-24, 7-13, 3-5. Tm_4 about as in *D. mendotae*. Claws tapering to fairly sharp apex, without apical teeth; 3-5 long, slender spines arising from base of claws, some reaching apex of claw. Empodium long, curving up between claws, with numerous long, slender, curved spines. Minute spinous puvelli possibly present near base of claws. Lengths and ratios of leg segments as follows:

	Fe	Ti	Tm_1	$Tm_{2\text{-}5}$	LR	BV	SV
P_I	1740 (1560–1890)	1630 (1460–1740)	1060 (960–1120)	1100 (1180–1040)	0.65 (0.63–0.66)	4.01 (3.82–4.18)	3.20 (3.16–3.24)
P_{II}	1810 (1660–1990)	1540 (1430–1630)	760 (680–810)	850 (780–910)	0.49 (0.48–0.51)	4.86 (4.71–5.03)	4.41 (4.27–4.55)
P_{III}	1880 (1680–2030)	1700 (1600–1810)	1140 (1030–1240)	1230 (1140–1340)	0.67 (0.64–0.71)	3.84 (3.76–4.00)	3.15 (3.05–3.23)

HYPOPYGIUM. — Fig. 119. Tg IX with 4-13 setae/side; St IX with dorso-lateral region greatly produced along side of gonocoxite, projection reaching to or slightly beyond 0.5 of length of gonocoxite; projection with fairly numerous, short setae. Anal point slender, short, directed somewhat to nearly ventrad; apodemes not present on underside of Tg IX. L_{gncx} 336 (328-351), $L_{tot}:L_{gncx}$ 10. Basal plate fairly well developed, slightly produced disto-medially, with numerous microtrichia ventrally. Medial field scarcely developed. Gonostylus broadest in basal 0.4, then abruptly narrowing; gonostylus with subterminal peg and about 3 terminal teeth. Sternapodeme strongly produced antero-medially, fore margin truncate medially. Basal wedge small, rugose laterally.

DIAGNOSIS. — St IX strongly produced along gonocoxites, gonostylus abruptly narrowed and with apical teeth. *D. davisi* is the closest species but is easily separable with the above hypopygial characters.

MATERIAL EXAMINED. — *Alberta,* west end of shallow lake, Banff National Park, coll. ?, 3.VII.1957, 12 males (CNC); *British Columbia,* Yoho Val., 30 July 1935, A. L. Melander, 1 male (USNM); *Montana,* Glacier National Park, Renold's Creek at Going to the Sun Highway, alt. 5,800′, 24 July 1968, leg. Ron Hellenthall; on rocks, water 6°C., 7 males (UMn); *Washington,* Mt. Rainier, Glacier Station, 15 Aug. 1917, A. L. Melander, 1 male (USNM); *Washington,* Mt. Rainier, Paradise Park, August, 1917, A. L. Melander, 2 males (USNM); *Washington,* 3 mi. E., 6 mi. S. of Glacier, on rocks in meltwater stream, at timberline on Mt. Baker, 7 Sept. 1967, leg. D. Hansen, 18 males (UMn).

DISCUSSION. — This species is obviously closely related to *D. davisi* (cf. Figs. 119, 120). The gonostylus and long extension of the ninth sternite are quite different from *davisi,* however. I collected my specimens on rocks in a small (½-1 m wide), very steep, meltwater stream on Mt. Baker, Washington. The adults could run about on the rocks very rapidly and were difficult to catch with an aspirator. Furthermore, they were very reluctant to fly and could not be caught by sweeping a net close to the rocks.

LOCATION OF TYPES. — The holotype is a slide-mounted specimen from: USA, Washington, 3 mi. E., 6 mi. S. of Glacier, on rocks in meltwater stream, at timberline on Mt. Baker, 7 Sept. 1967, leg. D. Hansen; it is deposited in the collection of the Department of Entomology, University of Minnesota, St. Paul, Minnesota. All other specimens examined are designated as paratypes and are deposited as shown in "material examined."

Diamesa ancysta Roback

D. ancysta Roback, 1959: 1-2, Figs. 1-4 (described from 1 male from Montana; figures hypopygium, $Tm_{4\ \&\ 5}$).

Description (unless otherwise stated, n = 5 and measurements are in microns): as in *D. mendotae* except:

TOTAL LENGTH. — 5.8 (5.0-6.7) mm.

COLORATION (pinned specimen). — about as in *D. mendotae*.

ANTENNA. — longest flagellar setae 0.71 (0.65-0.79)L_{fl}; Flm_{13} with apical 0.17-0.23 spindle-shaped, mainly swollen ventrally; 2-4 short, slender setae dorso- and ventro-medially on Flm_1; long (MaxL 883-1268) flagellar setae 1-2 on Flm_1, 3-8 on Flm_2, 7-9 on Flm_3, increasing to about 13-16 on Flm_{12} (difficult to count on slides available), numerous on Flm_{13}; $\overline{L_{flm}}_{1-13} : \overline{W_{flm}}_{1-13}$ 107:73, 23:60, 25:58, 29:52, 28:53, 27:52, 27:51, 28:49, 33:48, 31:47, 38:46, 36:45, 1019:44; AR 2.16 (1.29-2.45); 1 preapical antennal seta; L_{pas} 49 (42-56); D_{pd} 209 (184-245); 1-2 pedicellar setae ventro-medially; H_{sc} 220 (198-245).

HEAD. — W_h 764 (717-809); dorsal ocular apodeme nearly absent to moderate; IOS/side 5 (3-8); PtOS about 15; inner verticals reaching to 0.50-0.65 of distance from dorso-medial margin of eye to midline of vertex. Clypeus slightly swollen anteriorly, about as long as wide; CS 17 (13-23). H_e 329 (303-364). $\overline{L_{ps}}_{2-5} : \overline{W_{ps}}_{2-5} : \overline{MaxL_{pss}}_{2-5}$ 132:44:130, 195:51:154, 191:45:136, 272:37:52; CP 0.96 (0.90-1.04); palpal stoutness 4.46 (4.21-4.61).

THORAX. — L_{th} 1.61 (1.50-1.73) mm, D_{th} 1.48 (1.38-1.65) mm. Antepronotal notch right-angled to slightly obtuse, medial corners rounded; LAS/side 9-14 (n = 3). Dorsocentrals uniserial or slightly staggered posteriorly; DCS/side 13 (7-18) (n = 20), $MaxL_{dcs}$ 188-244 (n = 3); PAS/side 14 (8-19); scutellar setae dispersed or very roughly in 3 rows; ScS about 46 (about 35-about 61) (difficult to count in slides available); ASR not measurable on slides available; 1-6 setae on epimeral II protuberance; 1 small seta antero-ventrally on postanepisternum II on 1 specimen.

WING. — L_w 4.1 (3.5-4.4) mm, W_w 1.25 (1.12-1.36) mm. Costal projection 114 (90-140) or 6.0 (5.0-6.6) times its width; VR 0.91 (0.90-0.93). Remigium with 1-2 (rarely 4) setae on hand, 0-2 weak setae and about 14-20 campaniform sensilla just beyond wrist, and 2-3 setae and 3-5 large and 10-12 smaller campaniform sensilla on distal 0.5 of forearm. Setae 19 (17-21) on R, 11 (10-13) on R_1, 2-6 on R_{4+5} (uniserial and dorsal on all). Campaniform sensilla 3 ventrally on Sc just beyond arculus, 2-3 dorsally on R_1, 1 (rarely 2) dorsally and 1 ventrally near base of R_{2+3}, and 3 (1-4) dorsally on R_{4+5}. Squama with 62 (50-75) strong setae, $MaxL_{sqs}$ 211 (178-238).

	Fe	Ti	Tm_1	Tm_{2-5}	LR	BV	SV
P_I	1560 (1430–1680)	1820 (1680–1930)	1280 (1160–1390)	1370 (1210–1500)	0.70 (0.65–0.74)	3.40 (3.28–3.54)	2.65 (2.54–2.82)
P_{II}	1770 (1610–1960)	1680 (1510–1830)	830 (740–920)	1060 (940–1160)	0.49 (0.48–0.53)	4.05 (3.88–4.33)	4.17 (3.91–4.33)
P_{III}	1990 (1790–2200)	2060 (1830–2300)	1330 (1140–1460)	1390 (1240–1480)	0.65 (0.61–0.70)	3.85 (3.72–4.02)	3.06 (2.87–3.20)

LEGS. — $\bar{L}_{p_I}:\bar{L}_{tot}$ 1.04; Fe I with postero-dorsal beard of 20-30 long setae on proximal 0.6. Apical spur of Ti I long, slender, with sparse prickles on basal 0.3; L_{tispI} 91 (64-100); L_{tispII} 60 (52-62); $L_{atispIII}$ 61 (57-64), $L_{ptispIII}$ 100 (95-109). Ti III with posterior comb of 16-23 spines arranged in a fairly regular single row. Spiniform setae on first 3 tarsomeres of P I-III as follows: 8 (4-12), 2-4, 0; 11 (7-14), 5-8, 0-1 (at 0.7); 17 (15-20), 8-11, 0-2 (between 0.4 and 0.8). Lengths and ratios of leg segments, p. 58.

HYPOPYGIUM (without reference to *D. mendotae*). — Fig. 125. Tg IX with 13 (10-17) setae/side. Anal point strong, gradually broadening basally, with short apical peg and usually with distal keel; strong apodemes on underside of Tg IX diverging and arching to antero-lateral corners of Tg IX (occasionally more parallel near base of anal point, as in *D. mendotae*); L_{gncx} 343 (330-360); $\bar{L}_{tot}:\bar{L}_{gncx}$ 17. Basal plate very well developed, with numerous strong microtrichia ventrally, disto-medial margin rounded and strongly produced. Medial field well developed, dorsal border not well delimited proximally but forming a fairly sharp ridge just slightly free from gonocoxite distally; medial field with numerous microtrichia, with setae particularly strong ventrally; usually several setae are found on an ill-defined mound ventrally on medial field; distal end of medial field fairly broad, free, straight or slightly curved mesad; medial field with 4-7 setae in proximo-dorsal corner. Basimedial setal cluster with numerous very long, strong setae radiating fan-like, setae reaching to base of opposite cluster. Gonostylus approximately of equal width throughout, with subterminal peg and short terminal ridge. Sternapodeme slender medially, with short projections anterolaterally; fore margin straight to concave medially. Basal wedge very strong, rugose, ending before distal margin of basal plate.

DIAGNOSIS. — Antenna plumose, eyes hairy; basal plate very strong, produced disto-medially; basimedial setal cluster strong; gonostylus fairly slender. *D. haydaki* is similar but lacks a well-developed basal plate. *D. cheimatophila* has a broader gonostylus and a larger medial field with a much larger free distal end. *D. chiobates* has fewer setae in the basimedial setal cluster and a broader, postero-mesad-directed free end of the medial field. *D. vockerothi* has a less well developed basal plate and stronger gonostylus and medial field.

MATERIAL EXAMINED. — *Alaska,* various localities near Anchorage, Seward Highway, and on Kenai Peninsula, June, Aug., Sept., Nov., 1965 and 1966, jeep trap, leg. K. M. Sommerman, 13 males (USNM); Matanuska, 4-27-44, leg. J. C. Chamberlin, rotary trap, 1 male (USNM); *Colorado,* 1 mile W of Golden, on rocks in Clear Creek, 27 March 1968, leg. D. Hansen, 1 male partly emerged from pupa, many pupal exuviae (UMn); *Idaho,* Latah Co., Trails Pond, found on ice and snow, 7 March 1969, leg. J. M. Gillespie, 9 males (UId and UMn); Lemhi Co., Salmon River, Hwy 93, 20 miles south of Salmon, 7 March 1965, leg. A. V. Nebeker, 1 male (ANSP); *Montana,* National Lead Co. Mill, near Greenough, Blackfoot River 3/19/58, leg. J. C. Spindler and A. N. Whitney, holotype male (ANSP); *Nevada,* Reno, 23 Dec. 1915, 29 Jan., 4 Feb., 5 Feb., 10 Feb. 1916, 6 males (USNM); *Utah,*

Salt Lake County, Big Cottonwood Creek: various localities along creek, various dates in Feb., March, 1965, leg. A. V. Nebeker, 14 males (ANSP); *Washington,* 12 mi. E, 3 mi. S of Glacier, east side of Mt. Baker, Artists' Point, 12 Sept. 1967, leg. D. Hansen, 2 males (UMn); Pullman, 15 March 1899, leg. R. W. Doane, 1 male (WashStU).

Discussion. — Dr. S. S. Roback kindly loaned me the holotype of of *ancysta* for examination. The hypopygium is slightly flattened on the slide, but the shape of the gonostylus, medial field, and produced basal plate are clear. The strong setae below the medial field are not on as pronounced a mound as in Fig. 125, and the AR is higher (2.6) than in my material, but this seems within the expected range of specific variation.

Location of type. — Holotype male at the ANSP.

Diamesa arctica (Boheman)

Chironomus arcticus Boheman, 1865: 574-575 (described from Spitsbergen).

Diamesa arctica (Boheman). Holmgren, 1869: 8, 48 (records 6 males, 9 females from Green Harbour, Spitsbergen).

D. poultoni Edwards, 1922: 213-214 (described from 9 males, 11 females from Spitsbergen and Prince Charles' Foreland; suggests it "may have formed part of Holmgren's series of *D. arctica*").

D. arctica (Boh.) (= *poultoni* Edw.). Edwards, 1924: 163, 173 (examination of Boheman's and Holmgren's material of *D. arctica;* synonymizes *D. poultoni*); Edwards, 1937: 360 (records 9 males, 9 females from North-East Land (off Spitsbergen)); Oliver, 1963: 177 (records from Hazen Camp, Ellesmere Island); Kureck, 1966: 276-277 (periodicity of emergence of adults from meltwater stream on Spitsbergen; specimens determined by Serra-Tosio); Serra-Tosio, 1967a: 204-208 (description, figure of genitalia, discussion of application of name *arctica;* records specimen from Brundin collection from Sweden); Hirvenoja, 1967: 52-53 (records 16 males, 12 females from Spitsbergen); Serra-Tosio, 1969a: 205, 206 (records additional specimens from Brundin collection from Sweden (B-147: Lappland: Riksgransen, River Katterjokk, 9-9-1950)); Serra-Tosio, 1971: 143-145, Fig. 54.1-3 (description of adult male, distribution, figures of hypopygium);

[*non*] *D. arctica* (Boh.). Kieffer, 1911a: 274-275 (records 3 females from Bear Island, 3 males, 1 female from Spitsbergen; Kieffer (1919: 42) later states that he misdetermined the specimens and renames the species *D. lundstroemi*); Kieffer, 1911b: 19 (brief note of eye pubescence in (apparently) the above specimens); Kieffer, 1919: 41 (misdetermination of some species with 10 flagellomeres); Edwards, 1922: 212-213 (misdetermination of *D. bohemani* Goet.); Edwards, 1924: 163, 173 (says what he (Edwards, 1922) determined as *D. arctica* is possibly *D. waltli* Mg.); Goetghebuer and Lindroth, 1931: 280 (records from Iceland; misdetermination of *D. bohemani*); Edwards, 1932: 45 (misdetermination of *D. bohemani;* suggests it may be incorrectly determined); Mani, 1968: 393 (states it was collected in Alaska, but localities given are those

given by Malloch (1919) for *Pseudodiamesa arctica* (Malloch)); Young, 1969 misdetermination by D. Hansen (chagrin) of *D. spinacies* Saether).
[?]*D. arctica* (Boh.). Edwards, 1925: 356 (records 2 females from Spitsbergen).

Description (unless otherwise stated, n = 4 and measurements are in microns): as in *D. mendotae* except:

TOTAL LENGTH. — 4.6 (4.1-4.9) mm.

COLORATION. — not noted before slide mounting.

ANTENNA (n = 1). — longest flagellar seta $0.62L_{fl}$; Flm_{13} with apical 0.21-0.22 spindle-shaped, mainly swollen ventrally; 2 short, slender setae dorso- and ventromedially on Flm_1; long (MaxL 843) flagellar setae 1 on Flm_1, 4 on Flm_2, 7 on Flm_3, increasing to 13-15 on Flm_{12}, numerous on Flm_{13}; $\bar{L}_{flm_{1-13}} : \bar{W}_{flm_{1-13}}$ 85:46, 22:39, 22:41, 24:41, 24:41, 24:39, 24:39, 29:37, 29:37, 32:37, 34:37, 37:37, 737: 37; AR 1.56; 1 preapical antennal seta; L_{pas} 40; D_{pd} 166 (159-178) (n = 4); 2-4 pedicellar setae ventro-medially (n = 4); H_{sc} 155 (146-163) (n = 4).

HEAD. — W_h 563 (543-594); epistomal suture moderate medially, weak laterally; IOS/side 3-5; PtOS/side 14-16; inner vertical setae not well differentiated from outer verticals; inner verticals reaching to 0.58 (0.50-0.66) of distance from dorso-medial margin of eye to mid-line of vertex. Clypeus slightly swollen anteriorly, about as wide as long; CS 15 (12-19). Eyes not hairy, microtrichia appearing as coarse projections antero-medially, just slightly shorter than height of ommatidial lenses laterally; H_e 250 (232-265). $\bar{L}_{ps_{2-5}} : \bar{W}_{ps_{2-5}} : \overline{MaxL}_{pss_{2-5}}$ 88:39:96, 129:43:89, 124:36:73, 184:31:29; D_{so} 15 (14-16); CP 1.07 (1.00-1.10); palpal stoutness 3.54 (3.23-4.21).

THORAX. — L_{th} 1.14 (1.00-1.26) mm, D_{th} 1.08 (0.95-1.19) mm. Antepronotum with medial commissure strong, not reaching rear margin of phragma I, not surpassing scutal process (n = 1); antepronotal notch obtuse, weak, with medial corners rounded and moderately surpassing scutal process (n = 1); LAS/side 7 (4-13). Postpronotal apophyses weak in slides available; dorsocentrals uniserial; DCS/side 7-9, $MaxL_{dcs}$ 153 (139-168); PAS/side 8 (5-10); ScS 28 (22-40), $MaxL_{scs}$ 208 (188-218); ASR 0.66 (0.61-0.69); 0-3 setae on epimeral II protuberance.

WING. — L_w 3.2, 3.7 mm (n = 2), W_w 1.09 mm (n = 1). Dry wing not available. Slide mounted wing showing: costal projection 89-129, or 4.5-5.9 times its width; VR 0.75, 0.89 (n = 2). Remigium with 1 strong seta on hand, 1 weak seta and about 13 campaniform sensilla just beyond wrist, and 1-3 setae and 4 large and about 8 smaller campaniform sensilla on distal 0.5 of forearm. Setae 14 (8-18) on R, 9-12 on R_1, 3-9 on R_{4+5} (uniserial and dorsal on all). Campaniform sensilla 3 ventrally on Sc just beyond arculus, 2 dorsally on R_1, 1 dorsally and 1 ventrally near base of R_{2+3}, and 3-5 dorsally on R_{4+5}. Squama with 39-54 strong setae, $MaxL_{sqs}$ about 150.

LEGS. — $\bar{L}_{p_I} : \bar{L}_{tot}$ 0.86. Apical spur of Ti I long, slender, with sparse prickles on basal 0.3-0.5; L_{tispI} 75 (69-90); apical spurs on Ti II slightly stouter, subequal to equal in length, with rather fine prickles on basal 0.5-0.6; L_{tispII} 54 (48-60); $L_{atispIII}$ 45-52, $L_{ptispIII}$ 74-86. Weak polygon pattern occasionally visible near apex of Ti I; polygon pattern on Ti III usually well developed. Spiniform setae on first 3 tarsomeres of P I-III as follows: 2-3, 2 (apical), 0; 9-12, 4-5, 0; 9-15, 6-8, 0-1 (at 0.6). Lengths and ratios of leg segments as follows:

	Fe	Ti	Tm_1	$Tm_{2\text{-}5}$	LR	BV	SV
P_I	1110 (1040–1240)	1160 (1030–1410)	790 (660–970)	910 (810–1080)	0.68 (0.64–0.69)	3.37 (3.30–3.44)	2.92 (2.72–3.16)
P_{II}	1290 (1190–1500)	1070 (960–1230)	500 (420–550)	720 (690–760)	0.47 (0.42–0.53)	3.97 (3.76–4.33)	4.72 (4.32–5.32)
P_{III}	1470 (1340–1680)	1410 (1260–1460)	870 (770–1030)	980 (920–1110)	0.61 (0.56–0.66)	3.82 (3.65–4.00)	3.35 (3.16–3.61)

Hypopygium (without reference to *D. mendotae*). — Fig. 134. Tg IX with 10-13 setae/side. Anal point fairly long, slender, with very small apical peg; strong apodemes on underside of Tg IX diverging from base of anal point, running to antero-lateral corners of Tg IX; L_{gncx} 324 (314-341); $\bar{L}_{tot}$:$\bar{L}_{gncx}$ 14. Basal plate fairly well developed, obtuse to right-angled disto-medially, with numerous microtrichia ventrally. Medial field well developed, with well-delimited dorsal border, with numerous microtrichia and setae; setae particularly strong antero-ventrally; very distal end of medial field free. Gonostylus slender, broadest at about 0.2 its length, then narrowing beyond fairly rapidly, with distal 0.6 tapering just slightly distally; gonostylus with subterminal peg and weak, short terminal ridge. Sternapodeme a fairly simple slender arch, somewhat broadened medially. Basal wedge short but well-developed, slightly rugose.

Diagnosis. — Antenna plumose, eyes not hairy; medial field well developed, distal end free, dorsal border well delimited. *D. spinacies* is the closest species; see its diagnosis.

Material examined. — *Alaska,* Kenai Pen., Seward-Primrose GC, 17 June 1965, K. M. Sommerman, jeep trap, 2 males (USNM); Palmer, 23 IX 1964, jeep trap, K. M. Sommerman, 1 male (USNM); [*North West Territories*], Resolute Creek, Cornwallis Is., 14.VIII.60, D. R. Oliver, NC. 6-3, 1 male (CNC); ND 16-4, Devon Is., 5.IX.60, Devon Is. Exp., coll. D. R. Oliver, 4 males (CNC); ND.15-5, Stream in canyon near Base Camp, Devon Is., 4.IX.60, D. R. Oliver, 5 pupae (CNC); ND 17, Truelove R., Devon Is., 5.IX.60, D. R. Oliver, about 32 pupae (CNC); ND. 17-5, Truelove R., Devon Is., 5.IX.60, Devon Is. Exp., coll. D. R. Oliver, 3 teneral males (CNC).

Discussion. — Like a good number of chironomids, *arctica* is unrecognizable from its original description. Edwards (1922) described *D. poultoni* and *poultoni* var. *flavipila* from Spitsbergen and Prince Charles Foreland; fortunately, he did figure the hypopygium. Two years later, Edwards (1924) examined the material of both Boheman and Holmgren at the Stockholm Museum and was thus able to synonymize his *D. poultoni* with *arctica.* It seems a little surprising, therefore, that Edwards (1932) later incorrectly applied the name *arctica* to *D. bohemani.* Oliver (1963) first recorded the species from the Nearctic.

D. arctica is obviously most closely related to *D. spinacies*. It differs from *spinacies* mainly in the shape of the gonostylus.

LOCATION OF TYPES. — Edwards (1924) states that Boheman's oriinal material was, at that date, in the Stockholm Museum. I have not borrowed any of Boheman's series of *arctica*, nor has any other worker, but I presume it is still extant. A lectotype should, of course, be eventually designated from Boheman's material.

Diamesa bertrami Edwards

D. bertrami Edwards, 1935: 470 (described from 1 male from Cape Dalton, East Greenland; figures hypopygium); Pagast, 1947: 465 (suggests his new species *D. kasailica* is possible *D. bertrami*); Brundin, 1947: 47 (records 1 male from Sweden); Wuelker, 1959: 339, 344 (notes Thienemann's (1950c) misdetermination of *D. bertrami* as *D. latitarsis*); Oliver, 1962: 5, 6 (records 8 males from Bear Island; figures hypopygium); Serra-Tosio, 1964: 46 (records from France); Serra-Tosio, 1966: 125, 126, 127 (records from France, discussion of distribution); Laville, 1966: 209 (records 3 males from Lac d'Oredon, France); Albu, 1967 (reference cited by Serra-Tosio (1971), not seen by author); Saether, 1968: 455 (records 3 males from Finse area, Norway); Serra-Tosio, 1969a: 205 (records 54 males from Brundin collection from Sweden and Norway); Serra-Tosio, 1970c: 26 (records 7 males from Granada, Spain); Serra-Tosio, 1971: 147-155, Figs. 56-59, 153 (description of male and female adults and pupae; distribution; ecology).

D. latitarsis Goet. Thienemann, 1950c: 204-206 (misdetermination; figures hypopygium).

D. spec. II. Thienemann, 1941: 189 (records female pupal exuviae from Swedish Lapland); Pagast, 1947: 525, 573 (description of pupa; *fide* Wuelker, 1959, Serra-Tosio, 1964).

Description (unless otherwise stated, n = 3 and measurements are in microns): as in *D. mendotae* except:

TOTAL LENGTH. — 3.5 (3.2-4.0) mm.

COLORATION. — not noted before slide mounting.

ANTENNA. — longest flagellar seta 0.65-0.75L_{fl}; Flm_{13} with apical 0.24-0.29 spindle-shaped, mainly swollen ventrally; 1-2 short, slender setae dorso- and ventromedially on Flm_1; long (MaxL 654-900) flagellar setae 1 on Flm_1, 3 on Flm_2, 6-9 on Flm_3, 7-10 on Flm_4, increasing to 14-15 on Flm_{12}, numerous on Flm_{13}; setae on basal 0.2 of spindle-shaped region of Flm_{13}; $\overline{L}_{flm_{1\text{-}13}} : \overline{W}_{flm_{1\text{-}13}}$ 79:48, 19:42, 24:41, 26:39, 26:39, 30:39, 32:38, 35:38, 39:37, 41:35, 43:34, 43:35, 608:34; AR 1.25 (1.12-1.46); 1 preapical antennal seta; L_{pas} 33 (24-42); D_{pd} 157 (146-166); 1-3 pedicellar setae ventro-medially; H_{sc} 172 (147-189).

HEAD. — W_h 584 (553-625); dorsal ocular apodeme absent to weak; epistomal suture weak medially, absent laterally; IOS/side 2-3; postocular setae in uniserial row running from near postero-ventral margin of eye dorsally to merge with about 4 stronger, longer outer vertical setae; inner vertical setae few (about 6), shorter,

weaker, more curved and decumbent than outer verticals, roughly in a line or only slightly dispersed on dorsal region of vertex; inner verticals reaching to 0.33-0.40 of distance from dorso-medial margin of eye to midline of vertex. Clypeus slightly swollen anteriorly, about as wide as long; CS 9 (7-14). Eyes hairy, microtrichia about 1.5 times height of ommatidial lenses; dorso-medial margin extending not quite as far mesad as ventro-medial margin; H_e 285 (279-289). $\bar{L}_{ps_{2\text{-}5}} : \bar{W}_{ps_{2\text{-}5}} : \overline{MaxL}_{pss_{2\text{-}5}}$ 85:30:83, 137:37:73, 140:29:75, 152:25:27; D_{so} 14 (12-16); CP 1.08 (0.94-1.27); palpal stoutness 4.5 (3.95-4.91).

THORAX. — L_{th} 1.05 (0.95-1.20) mm (n = 5), D_{th} 1.01 (0.90-1.17) mm (n = 5). Antepronotum with medial commissure strong, not quite reaching rear margin of phragma I, slightly surpassing anterior margin of scutal process; antepronotal notch right-angled to very obtuse, medial corners broadly to very broadly rounded and moderately or only slightly surpassing scutal process; LAS/side 7-10. Dorsocentrals uniserial; DCS/side 8 (6-11) (n = 10), $MaxL_{dcs}$ 150 (n = 2); PAS/side 6 (5-8); scutellar setae dispersed; ScS 14-26 (n = 2), length not measurable on slides available; ASR 0.63 (0.58-0.68); 1-4 setae on epimeral II protuberance.

WING. — L_w 2.8 (2.5-3.0) mm, W_w 0.88 (0.80-0.94) mm. Dry wing not available. Slide mounted wing showing: costal projection 59-109 or 3.8-5.5 times its width; M_{1+2} weak; apparent m-cu distal to apparent fCu by about 2-3 times width of apparent m-cu; VR 0.92 (0.90-0.94). Remigium with 1 strong seta on hand, 1 weak seta and apparently about 6-about 14 campaniform sensilla just beyond wrist, and 2-3 setae and 4-5 large and about 7 smaller campaniform sensilla on distal 0.5 of forearm. Setae 12-13 on R, 10-11 on R_1, 1-2 on R_{4+5} (uniserial and dorsal on all). Campaniform sensilla 3 ventrally on Sc just beyond arculus, 2 dorsally on R_1, 1 dorsally and 1 ventrally near base of R_{2+3}, and 0-2 dorsally on R_{4+5}. Squama with 34, 38 (n = 2) strong setae, $MaxL_{sqs}$ 139, 150 (n = 2).

LEGS. — $\bar{L}_{p_I} : \bar{L}_{tot}$ 1.27. Fe I with only 1 long seta (other setae possibly forming femoral beard broken off in slides available). Apical spur of Ti I long, slender, with very sparse, short prickles on basal 0.3-0.5; L_{tispI} 64-79; apical spurs of Ti II stouter, subequal to equal in length, with fairly numerous prickles on basal 0.5; L_{tispII} 45-55; apical spurs of Ti III with numerous prickles on basal 0.4-0.5; $L_{atispIII}$ 43-52, $L_{ptispIII}$ 64-79. Polygon pattern on Ti III well developed. Ti III with posterior comb of 15-18 spines arranged in fairly regular row. Spiniform setae on first 3 tarsomeres of P I-III as follows: 2 (apical), 2 (apical), 0; 8-11, 3, 0; 12-13, 4-7, 0. Lengths and ratios of leg segments as follows:

	Fe	Ti	Tm_1	$Tm_{2\text{-}5}$	LR	BV	SV
P_I	1040–1240	1210–1480	920–1110	860–1090	0.75–0.83	3.50–4.06	2.24–2.45
P_{II}	1160–1340	1130–1340	550–660	660–790	0.48–0.50	4.22–4.32	4.09–4.19
P_{III}	1280–1530	1340–1630	910–1080	870–1040	0.64–0.68	4.04–4.09	2.89–3.09

HYPOPYGIUM. — indistinguishable from *D. chorea*.

DIAGNOSIS. — Antenna plumose, eyes hairy, basimedial setal cluster absent. The shape of the gonostylus and medial field are unlike any other *Diamesa* with hairy eyes. The hypopygium of D. *chorea* is identical, but *chorea* has non-hairy eyes.

MATERIAL EXAMINED. — [*Bear Island*], Tromsö Museums Björnöya Expd., Sta. 19, Bear I. 25.VIII.1957, 1 male (CNC); Svarthulpen, 25. Aug. 1957, Tromsö Mus. Bear Is. Expd., No. B [3?].3, 1 male (CNC); [*Austria*], Obergurgl, TIROL, 1950m., 18, 20, 26-VII, 8-VIII-1953, J. R. Vockeroth, 4 males (CNC).

DISCUSSION. — Edwards (1935) described *bertrami* from a single specimen from Greenland. The hypopygial figure he drew was rather poor, however. Thienemann (1950c) briefly described the species (misdetermined as *latitarsis*) and presented a hypopygial figure drawn by Strenzke. He apparently noticed the fine fringe of setae on the aedeagal lobes. Oliver (1962) gave an accurate hypopygial figure of a specimen from Bear Island and stated that the species is similar to *D. clavata.* Actually, *bertrami* is almost identical to *chorea;* see its discussion.

LOCATION OF TYPE. — British Museum (Natural History). I did not see the holotype.

Diamesa bohemani Goetghebuer

D. bohemani Goetghebuer, 1932: 181 (in part) (description of specimens from Austria, Iceland, and Spitsbergen; figures hypopygium, which is actually that of what is now called *D. zernyi* Edw.; described as "nom. nov." for *Waltli* Edw. *nec* Meig. and *arctica* Edw. *nec* Boh.); Edwards, 1933: 616-617 (records 1 male from Akpatok Island, Hudson Strait; splits "*bohemani*" into a northern and a southern species, *bohemani* and *zernyi* Edw., respectively); Pagast, 1947: 480-481, 530 (description of adult male; figures hypopygium; description of pupa of *zernyi,* with mention that a pupal exuviae from East Greenland, probably *bohemani,* was indistinguishable from that of *zernyi*); Thienemann, 1950b: 543, 565 (regards as the northern member of the "species pair" *bohemani-zernyi*); Wuelker, 1958: 807 (records from Germany); Wuelker, 1959: 349-350 (discussion of nomenclatorial confusion); Oliver, 1962: 6, Fig. 3 (records 7 males from Bear Island; figures hypopygium); Albu, 1967 (cited by Serra-Tosio, 1971; not seen by author); Saether, 1968; 455-456 (records 5 males from Finse area, Norway); Serra-Tosio, 1969a: 205, 206 (records 65 males from various localities in Sweden, from Brundin collection); Serra-Tosio, 1971: 211-214, Fig. 90, 91 (description of adult male, male pupa; distribution; records from Spitsbergen, Sweden, Norway).

D. arctica [Boh.]. Edwards, 1922: 212-213, Fig. 13 (misdetermination of 1 male from Spitsbergen); Goetghebuer and Lindroth, 1931: 274 (records 3 males and 5 females from Iceland); Edwards, 1932: 45 (records from Loch Einich and Loch Laidon; states it may not be *arctica*).

D. edwardsi Goetghebuer, *in* Goetghebuer and Lenz, 1939: 13, Fig. 20 (as "nom. nov." for *D. Waltli* Edw. *nec* Meig. and *arctica* Edw. *nec* Boh.); Soot-Ryen,

1942: 83 (records 1 male from Spitsbergen (det. Goetghebuer)); Soot-Ryen, 1943: 19 (records 2 males, 1 female from northern Norway (det. Goetghebuer)); Brundin, 1947: 47 (records 5 males, 1 female from Sweden).

D. Waltli Mg. Edwards, 1929: 304-305, Fig. 2d (questions determination; states he has "seen only 1 British male, from Whernside"); Coe, 1950: 136, Fig. 182d new records in Great Britain).

[*non*] *D. bohemani* Goet. Goetghebuer and Lenz, 1939: 11 (as senior synonym to *D. zernyi* Edw., *arctica* Goet. *nec* Boh.; misdetermination of *zernyi*); Laville, 1966: 209 (misdetermination of *D. zernyi, fide* Serra-Tosio, 1969: 206).

[*non*?] *D. bohemani* Goet. Goetghebuer, 1945: 197 (records from Belgium; actually *zernyi*?).

Description (unless otherwise stated, n = 3 and measurements are in microns): as in *D. mendotae* except:

Total length. — not measurable on slides available.

Coloration. — not noted.

Antenna (n = 1). — longest flagellar setae 0.70 L_{fl}; Flm_{13} wth apical 0.23 spindle-shaped, mainly swollen ventrally; 2 short, slender setae dorso- and ventromedially on Flm_1; long (MaxL 900) flagellar setae 1 on Flm_1, 3 on Flm_2, 7 on Flm_3, increasing to about 14 on Flm_{12}, numerous on Flm_{13}; $L_{flm_{1\text{-}13}}$ 101, 16, 24, 28, 30, 36, 40, 42, 46, 50, 55, 50, 720; AR 1.29; 1 preapical antennal seta; L_{pas} 46; D_{pd} 180; 3 pedicellar setae ventro-medially; H_{sc} 178.

Head (n = 1). — W_h 622; dorsal ocular apodeme moderate; IOS/side 2, 3; PtOS about 13; inner verticals reaching to about 0.5 of distance from dorso-medial margin of eye to midline of vertex. Clypeus slightly swollen anteriorly, about as wide as long; CS 14. H_e 278. $L_{p3_{2\text{-}5}}$:$W_{p3_{2\text{-}5}}$:$MaxL_{pss_{2\text{-}5}}$ 99:30:91, 135:48:89, 143:36:79, 216:32:22; D_{so} 14; CP 1.07; palpal stoutness 3.77.

Thorax (n = 1). — L_{th} 1.24 mm, D_{th} 1.17 mm. Antepronotum with medial commissure and antepronotal notch not visible in slides available; LAS/side 10; dorsocentrals apparently uniserial; DCS/side 13, $MaxL_{dcs}$ 188; PAS/side 9; ScS 26, $MaxL_{scs}$ 200. ASR 0.61; 4 setae on epimeral II protuberance.

Wings. — L_w 3.3-3.6 mm, W_w 1.02-1.14 mm. Costal projection 97-117 or 5.0-6.0 times its width; apparent m-cu distal to apparent fCu by about 2-3 times width of apparent m-cu; VR 0.91-0.94. Remigium with 1 strong seta on hand, 0-1 seta and about 11-13 campaniform sensilla just beyond wrist, and 1-4 setae and 4 large and 7-11 smaller campaniform sensilla on distal 0.5 of forearm. Setae 14-22 on R, 8-14 on R_1, and 3-9 on R_{4+5} (uniserial and dorsal on all). Campaniform sensilla 3 ventrally on Sc just beyond arculus, 2-3 dorsally on R_1, 1 dorsally and 1 ventrally near base of R_{2+3}, and 3-4 dorsally on R_{4+5}. Squama with 34-62 strong setae, $MaxL_{sqs}$ 173-200.

Legs. — $\overline{L}_{p_I}$:$\overline{L}_{tot}$ not measurable on slides available. Apical spurs of Ti I long, slender, with sparse prickles on basal 0.3; apical tibial spurs otherwise as in *D. mendotae*. Spiniform setae on first 3 tarsomeres of P I-III as follows: 2 (apical)-5, 2 (apical), 2 (apical); 12-14, 6-8, 2 (apical); 12-18, 6-10, 2 (apical)-3. Lengths and ratios of leg segments as follows:

	Fe	Ti	Tm_1	$Tm_{2\text{-}5}$	LR	BV	SV
P_I	1310–1560	1510–1720	1060–1240	1160–1340	0.70–0.72	3.35–3.70	2.64–2.67
P_{II}	1430–1760	1390–1690	720–840	870–1060	0.50–0.53	4.05–4.33	3.91–4.10
P_{III}	1650–1930	1700–2060	1110–1360	1160–1330	0.62–0.66	3.84–4.06	2.93–3.23

HYPOPYGIUM (without reference to *D. mendotae*). — Fig. 115. Tg IX with 11-17 setae/side. Anal point very strong, fairly broad, broadening basally, with distal keel, with or apparently without apical peg; strong apodemes on underside of Tg IX diverging and arching to antero-lateral corners of Tg IX; L_{gncx} 558-568; L_{tot}:L_{gncx} not measurable. Gonocoxite very long, slender; basal plate scarcely developed. Medial field well developed, very long, with dorsal border fairly well delimited; medial field with very few microtrichia but with numerous strong, anteriorly-directed setae on distal 0.4; distal end of medial field free. Basimedial setal cluster with about 15 long, strong setae directed antero-mesad, setae reaching to or just beyond midline of hypopygium; basimedial setal cluster located posterior to posterior margin of basal foramen. Gonostylus short, broadest at about 0.3, with strong subterminal peg and short terminal ridge. Sternapodeme fairly broad medially, with weak antero-lateral projections; fore margin slightly concave medially. Basal wedge weakly sclerotized, very broad, rugose, reaching about to level of posterior margin of Tg IX.

DIAGNOSIS. — The long, slender gonocoxite, strong anal point, and medial field with the anteriorly-directed setae are unlike any other Nearctic species. The European *D. zernyi* can be distinguished by the characters in Serra-Tosio (1971).

MATERIAL EXAMINED. — [*Iceland*], Surtsey, Vestmannaeyjar Island 28.VI.1966, coll. H. Andersson, *Diamesa zernyi* Edw. [det. ?], 1 male (CNC); Heimacy Loc. 7 [?], Vestmannaeyjar, Iceland, 23 July 1965, coll. H. Andersson, *Diamesa zernyi*, det. D. R. Oliver, 1 male (CNC); Surtsey, Vestmannaeyjar Iceland, 14.VII.1967, coll. H. Richter, *Diamesa zernyi*, det. D. R. Oliver, No. DRO 8-51, 1 male (CNC); [*Greenland*], 500 ft. S. Greenland, VIII.29.47, J. M. Amberson, *Diamesa bohemani* Goetgh., det. Stone, 2 males (USNM); [North West Territories], Fly'g over and nr. stream, valley head, A. K. Gregson, 3 Sept. 1931, O. U. Exp. 1931, S. Akpatok I., Ungava Bay, N. Canada, A. K. Gregson, d.d. 1931, *Diamesa bohemanni* [*sic*] Gret. [*sic*], Det. in B. M. F. W. Edwards May 1933, 1 male (Oxford).

DISCUSSION. — The nomenclatorial treatment of *bohemani* was discussed by Wuelker (1959); records since then are given in my synonymy. Oliver (1962) stated that *bohemani* lacks a basimedial setal cluster and is therefore distinguishable from *D. zernyi* which does have basimedial setae. *D. bohemani* does, however, have a basimedial setal cluster, although the number (up to 15) and the length (reaching about to the mid-

line of the hypopygium) of the setae are less than in *zernyi* (cf. Serra-Tosio, 1971: Pls. 83, 84 and 90, 91).

Location of type. — Edwards (1933) designated a male from Spitzbergen in the BM(NH) as the holotype.

Diamesa cheimatophila [5] n. sp.

Description (unless otherwise stated, n = 5 and measurements are in microns): as in *D. mendotae* except:

Total length. — 5.3 (4.8-5.8) mm (n = 4).

Coloration (pinned specimen). — as in *D. mendotae*.

Antenna. — longest flagellar setae 0.72 (0.68-0.75)L_{fl}; Flm_{13} with apical 0.17-0.27 spindle-shaped, mainly swollen ventrally; 2 short, slender setae dorso- and ventro-medially on Flm_1; long (MaxL 768-1024) flagellar setae 1 on Flm_1, 3-4 on Flm_2, 8-10 on Flm_3, increasing to 13-15 on Flm_{12}, numerous on Flm_{13}; setae on basal 0.2-0.4 of spindle-shaped apex of Flm_{13}; $\overline{L}_{flm_{1-13}} : \overline{W}_{flm_{1-13}}$ 103:67, 22:58, 23:58, 27:54, 25:51, 23:50, 24:48, 26:47, 29:45, 32:45, 34:42, 36:42, 888:40; AR 1.88 (1.69-2.06); 1 preapical antennal seta; L_{pas} 50 (41-56); D_{pd} 188 (171-198); 1 or 2 pedicellar setae ventro-medially; H_{sc} 197 (180-203).

Head. — W_h 733 (666-778); dorsal ocular apodeme absent or weak; epistomal suture usually strong medially, weak laterally; IOS/side 5 (3-8); inner verticals reaching to 0.39-0.63 of distance from dorso-medial margin of eye to midline of vertex; CS 16 (15-19); H_e 331 (298-355); $\overline{L}_{ps_{2-5}} : \overline{W}_{ps_{2-5}} : \overline{MaxL}_{pss_{2-5}}$ 128:52:139, 182:59:193, 190:50:197, 253:38:62; CP 0.99 (0.92-1.06); palpal stoutness 3.76 (3.47-4.07).

Thorax. — L_{th} 1.35 (1.17-1.51) mm, D_{th} 1.24 (1.09-1.41) mm (n = 6). Antepronotum with medial commissure strong, not quite reaching to rear margin of phragma I, reaching to or slightly surpassing anterior margin of scutal process; antepronotal notch acute to right-angled, medial corners rounded; LAS/side 8 (5-11); dorsocentrals uniserial to slightly staggered posteriorly; DCS/side 11 (8-15), $MaxL_{dcs}$ about 286 (n = 4); PAS/side 6 (5-10); ScS about 28-32 (n = 4), $MaxL_{scs}$ 270-327 (n = 4); ASR 0.62 (0.58-0.65); 0-4 setae on epimeral II protuberance.

Wing. — L_w 3.9 (3.2-4.3) mm, W_w 1.20 (1.02-1.28) mm. Costal projection 123 (89-149) or 6.0 (4.5-6.5) times its width; VR 0.91 (0.90-0.93). Remigium with 0, 1 strong, or 1 strong and 1 weak seta on hand, 0-2 weak setae and about 6-about 15 campaniform sensilla just beyond wrist, and 2-3 setae and 3-4 large and about 9 smaller campaniform sensilla on distal 0.5 of forearm. Setae 14 (9-18) on R, 10 (8-12) on R_1, 9 (8-11) on R_{4+5} (uniserial and dorsal on all). Campaniform sensilla 3 ventrally on Sc just beyond arculus, 1-3 dorsally on R_1, 1 (rarely 2) dorsally and 1 (rarely 2) ventrally near base of R_{2+3}, and 2-4 dorsally on R_{4+5}. Squama with 45 (32-58) strong setae, $MaxL_{sqs}$ 140-210.

Legs. — $\overline{L}_{p_{I}} : \overline{L}_{tot}$ 1.13. Apical spurs essentially as in *D. mendotae*. Spiniform setae on first 3 tarsomeres of P I-III as follows: 6-12, 2-5, 0-1 (at about 0.7); 11-13, 6-8, 0-3; 14-18, 8-11, 2 (at about 0.6). Lengths and ratios of leg segments as follows:

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[5] From *cheima, -tos* (Gr.), winter, and *philia* (Gr.), fondness, affection (Brown, 1954). The midge is a "lover of winter."

	Fe	Ti	Tm_1	Tm_{2-5}	LR	BV	SV
P_I	1630 (1390–1760)	1880 (1580–2030)	1210 (1080–1310)	1270 (1140–1340)	0.65 (0.62–0.68)	3.69 (3.54–3.76)	2.89 (2.77–3.00)
P_{II}	1800 (1510–1960)	1670 (1410–1790)	760 (660–820)	980 (860–1060)	0.45 (0.40–0.48)	4.32 (4.19–4.44)	4.61 (4.35–5.12)
P_{III}	2030 (1680–2230)	2020 (1720–2200)	1270 (1110–1380)	1350 (1210–1460)	0.63 (0.60–0.65)	3.92 (3.73–4.03)	3.19 (3.07–3.34)

Hypopygium (without reference to *D. mendotae*). — Fig. 131. Tg IX with 20 (13-25) setae/side. Anal point strong, broadening slightly basally, with short apical peg and distal keel or ridge; strong apodemes on underside of Tg IX running nearly parallel to near fore margin of Tg IX, then diverging and running along fore margin of Tg IX; L_{gncx} 387 (337-407); L_{tot}:L_{gncx} 14. Basal plate well developed, with numerous strong microtrichia ventrally, disto-medial margin not produced. Medial field well developed, with dorsal border well delimited; medial field with numerous microtrichia, with setae particularly strong ventrally; distal 0.4 of medial field very broad, free, directed straight posteriorly; medial field without distinct group of setae in proximo-dorsal corner. Basimedial setal cluster with numerous very long, strong setae radiating fan-like, setae reaching to base of opposite cluster. Gonostylus fairly broad, with subterminal peg and short terminal ridge. Sternapodeme fairly narrow medially, with antero-lateral projections; fore margin concave medially. Basal wedge very strong, rugose, apex blunt, reaching to or nearly to distal end of basal plate.

Diagnosis. — Antenna plumose, eyes hairy, basimedial setal cluster strong; medial field with broad, posteriorly-directed free end; gonostylus broad. *D. cheimatophila* is most similar to *D. ancysta, chiobates, haydaki,* and *vockerothi.* It is easily separable from these species by its distinctive medial field.

Material examined. — *New York,* Chenango Co., East Guilford, 7 March 1966, Knutson, Morse, Pechuman, 2 males (Corn); Ithaca, 16-II-1963, Lambert W. All, 2 males (JES); Ithaca, III.4, 15.1936, H. K. Townes, 12 males (HKT); Ithaca, May, Diamesa nivoriunda Fitch, Det. O. A. Johannsen, 1 male (Corn); Ithaca, Buttermilk, 29-XII-1966, R. G. Beard, 1 male (Corn); Ithaca, Coy Glen, 29-XII-1966, R. G. Beard, col., 1 male (Corn); Ludlowville, 19-I-1963, L. L. Pechuman, on snow, 2 males (JES); Myers, Salmon Creek Bridge, 14 January 1967, leg. L. L. Pechuman, 2 males (Corn); New Field, Tompkins County, Rt. 13 nr. Co. Rd. 133, 2.III.1969, leg. Karl Valley, 3 males (Corn); Tompkins Co., Buttermilk St. Pk., Ithaca 26-II-1966, R. G. Beard, 1 male (Corn); Tompkins Co., Coy Glen, Ithaca, 25 Feb. 1966, R. G. Beard, 3 males (Corn).

Discussion. — *D. cheimatophila* is one of several species of what could be called the "*nivoriunda*" group, that is, species with a strong basimedial

setal cluster located below the basal plate. Its recorded emergence times are from December to May, although I presume that it probably starts to emerge in September.

Location of types. — Holotype is a slide-mounted male from: USA, New York, Newfield, Tompkins County, Rt. 13 nr. Co. Rd. 133, 2.III. 1969, leg. Karl Valley, slide DH 70-75; it is deposited in the Cornell University Collection. All other specimens examined are designated paratypes and are deposited either at Cornell, the University of Minnesota, or Dr. Henry K. Townes' collection.

Diamesa chiobates [6] new species

[?] *D. waltlii* Meigen. Malloch, 1915: 410-411, Pl. XXIII, Fig. 11.

Description (unless otherwise stated, n = 5 and measurements are in microns): as in *D. mendotae* except:

Total length. — 5.5 (4.4-6.2) mm (n = 10).

Coloration (pinned specimen). — as in *D. mendotae*.

Antenna. — longest flagellar setae 0.67 (0.61-0.76) L_{fl}; Flm_{13} with apical 0.14-0.21 spindle-shaped, mainly swollen ventrally; 2 short, slender setae dorso- and ventro-medially on Flm_1; long (MaxL 758-1075) flagellar setae 1 on Flm_1, 4-5 on Flm_2, 8-9 on Flm_3, increasing to about 14-16 on Flm_{12}, numerous on Flm_{13}; setae on basal 0.1-0.3 of spindle-shaped region of Flm_{13}; $\overline{L}_{flm_{1-13}}$: $\overline{W}_{flm_{1-13}}$ 99:64, 18:43, 22:54, 24:50, 23:49, 24:47, 24:46, 25:45, 29:45, 29:44, 33:42, 36:40, 1003:36; AR 2.39 (2.07-2.72) (n = 10); 1 preapical antennal seta; L_{pas} 45 (38-60); D_{pd} 191 (163-207); H_{sc} 205 (174-213).

Head. — W_h 723 (655-778); IOS/side 5 (4-7); PtOS 11-15; inner verticals reaching to 0.45-0.56 of distance from dorso-medial margin of eye to midline of vertex; CS 9 (6-12). H_e 322 (298-348). $\overline{L}_{ps_{2-5}}$: $\overline{W}_{ps_{2-5}}$: $\overline{MaxL}_{pss_{2-5}}$ 114:41:127, 179:49:132, 166:39:123, 228:31:48; D_{so} 17 (16-18); CP 1.03 (0.94-1.08); palpal stoutness 3.79 (3.33-4.24).

Thorax. — L_{th} 1.43 (1.28-1.62) mm (n = 10), D_{th} 1.34 (1.21-1.51) mm (n = 10). Antepronotal notch acute to slightly obtuse, medial corners rounded; LAS/side 9 (7-11); postpronotum without setae and with 2 or 3 small, indistinct sensilla (?) on antero-dorsal border; dorsocentrals uniserial or slightly staggered posteriorly; DCS/side 10 (8-13) (n = 20), $MaxL_{dcs}$ 195 (155-224); PAS/side 7.6 (5-11) (n = 16); ScS 27 (20-32), $MaxL_{scs}$ 265 (178-368) (n = 4); ASR 0.60 (0.57-0.64); 0-3 fine setae on epimeral II protuberance.

Wing. — L_w 3.5 (2.8-4.2) mm, W_w 1.02 (0.83-1.26) mm. Costal projection 122 (100-140) or 7.3 (6.3-8.6) times its width; VR 0.94 (0.90-0.96). Remigium with 1 or 2 setae on hand, 0-1 weak seta and about 4(?)-about 10 (difficult to count in slides available) campaniform organs just beyond wrist, and 3 (2-6) setae and 2-4 large and about 10 smaller campaniform sensilla on distal 0.5 of forearm. Setae 14 (11-17) on R, 8 (6-12) on R_1, 6 (4-9) on R_{4+5} (uniserial and dorsal on

[6] From *chion, -os* (Gr.), snow, and *bates* (Gr.), one that walks or treads (Brown, 1954). The species is often found in mid-winter walking about on the snow by an open stream, hence "one that walks on the snow."

all). Campaniform sensilla 3 ventrally on Sc just beyond arculus, 1-2 dorsally on R_1, 1 (rarely 2) dorsally and 1 ventrally near base of R_{2+3}, and 1-3 dorsally on R_{4+5}. Squama with about 32-60 strong setae, $MaxL_{sqs}$ 179 (130-220).

LEGS. — $\bar{L}_{p_I}:\bar{L}_{tot}$ 1.05; Fe I with distinct postero-dorsal beard of about 20-25 long setae on proximal 0.5. Apical spur of Ti I long, slender, with sparse prickles on basal 0.3-0.5; apical spurs otherwise as in *D. mendotae.* Spiniform setae on first 3 tarsomeres of P I-III as follows: 2-7, 2 (apical), 0; 9-13, 4-6, 0; 11-20, 7-10, 0-1 (at about 0.6). Lengths and ratios of leg segments as follows:

	Fe	Ti	Tm_1	$Tm_{2\text{-}5}$	LR	BV	SV
P_I	1530 (1260–1720)	1720 (1410–1960)	1240 (1090–1340)	1260 (1060–1330)	0.72 (0.67–0.77)	3.43 (3.36–3.58)	2.62 (2.45–2.81)
P_{II}	1680 (1360–1960)	1620 (1330–1830)	810 (700–880)	970 (810–1060)	0.50 (0.47–0.53)	4.22 (3.96–4.52)	4.05 (3.85–4.45)
P_{III}	1870 (1500–2230)	1950 (1560–2200)	1280 (1020–1410)	1280 (1060–1410)	0.65 (0.62–0.69)	3.97 (3.80–4.10)	3.00 (2.83–3.26)

HYPOPYGIUM (without reference to *D. mendotae*). — Fig. 126. Tg IX with 13 (8-18) setae/side. Anal point strong, broadening slightly basally, with short apical peg and distal keel; strong apodemes on underside of Tg IX diverging and arching to antero-lateral corners of Tg IX, occasionally running parallel for about 0.5 of length of Tg IX before diverging; L_{gncx} 325 (290-346); $L_{tot}:L_{gncx}$ 17. Basal plate well developed, with numerous strong microtrichia ventrally. Medial field well developed, dorsal border a fairly sharp ridge becoming free distally; medial field with numerous microtrichia, with setae particularly strong ventrally; distal 0.2 of medial field broad, free, slightly curving mesad; medial field with 3-6 setae in proximo-dorsal corner. Basimedial setal cluster with about 6-8 long, strong setae, setae reaching nearly to base of opposite cluster. Gonostylus about of equal width throughout, with subterminal peg and short terminal ridge. Sternapodeme fairly slender medially, with antero-lateral projections; anterior border slightly concave medially. Basal wedge very strong, rugose, blunt to pointed apically, not quite reaching distal end of basal plate.

DIAGNOSIS. — Antenna plumose, eyes hairy, basimedial setal cluster with only 6-8 setae; medial field with free distal end broad, curving postero-mesad.

MATERIAL EXAMINED. — *Minnesota,* Hubbard Co., Lower LaSalle Lake, N.J. mosquito trap, 22 Oct. 1970, leg. E. F. Cook, 1 male (UMn); Washington County, 2 mi. W, 1 mi. S of Lakeland, along Valley Creek, 31 Jan. 1967, leg. D. Hansen, 2 males (UMn); Washington County, 2 mi. W, 1 mi. S of Lakeland, by small stream near Valley Creek, 14 Feb. 1967, leg. D. Hansen, 7 males (UMn); *Wisconsin,* 45° 43′N, 92°09′W, 11 mi. E, 4 mi. S of Siren, Burnett County, March, April, Sept., Oct., 1966, 1968, 1969, 50 males (UMn); Mecan R., Waushara Co., T18N, R9E, sec16,

Hy 21 bridge, 9 Feb. 1967, leg. R. Narf, 6 males (JES); Sauk Co., Otter Ck., 22-II-1969, leg. R. Narf, 1 male (UMn).

DISCUSSION. — *D. chiobates* is another "*nivoriunda*-group" *Diamesa.* Its basimedial setal cluster is the weakest of any in this group, however, having only 6-8 setae. Malloch's (1915) "*D. waltlii*" is just possibly *D. chiobates,* although Malloch's hypopygial figure also shows a resemblance to *D. heteropus.* I have collected the species in company with *D. mendotae;* recorded emergence times are September-October and January-April, although I presume it emerges from September to May.

LOCATION OF TYPES. — Holotype is a male collected in: USA, Wisconsin, 45°43'N, 92°09'W, 11 mi. E, 4 mi. S of Siren, Burnett County. Light trap by small cold stream (Spring Brk) 8 Oct. 1968, leg. Dean Hansen, slide DH69-161. It is deposited in the collection of the Department of Entomology, University of Minnesota, St. Paul, Minnesota. The remaining specimens examined are designated as paratypes and are deposited at the UMn, USNM, CNC, and ANSP.

Diamesa chorea Lundbeck

D. chorea Lundbeck, 1898: 291-293 (described from males from Greenland); Lundstroem, 1918(?): 24, Taf. II, Fig. 36 (figures hypopygium of "Typus-Examplar"); Edwards, 1933: 618 (figures hypopygium of co-type); Edwards, 1935: 471 (records 6 males from Jameson Land); Soot-Ryen, 1943: 19; Pagast, 1947: 472-473 (description of male from Greenland).

[*non*] *D. chorea* Lundbeck. Cole and Lovett, 1921: 212 (misdetermination).

D. aberrata Lundbeck. Edwards, 1935: 471 (in part) (misdetermination of 1 of 4 specimens).

Description (unless otherwise stated, n = 3 and measurements are in microns): as in *D. mendotae* except:

TOTAL LENGTH. — 4.4 mm (n = 1).

COLORATION. — not noted.

ANTENNA. — longest flagellar seta 0.67 (0.62-0.71) L_{fl}; Flm_{13} with apical 0.21-0.27 spindle-shaped, mainly swollen ventrally; 2 short, slender setae dorso- and ventro-medially on Flm_1; long (MaxL 720-900) flagellar setae 1 on Flm_1, 3-4 on Flm_2, 6-7 on Flm_3, 10-12 on Flm_4, increasing to 14-15 on Flm_{12}, numerous on Flm_{13}; setae not on or only on basal 0.1 of spindle-shaped region of Flm_{13}; spindle-shaped region of Flm_{13} with numerous slender, pointed sensilla basiconica, apparently without any similar but blunter, shorter sensilla basiconica arising from more distinct pits, and with 5 ringed sensilla coeloconica; $\overline{L}_{flm_{1-13}}:\overline{W}_{flm_{1-13}}$ 82:51, 17:46, 22:44, 27:41, 26:40, 29:41, 32:41, 36:40, 38:38, 39:38, 38:37, 40:38, 666:37; AR 1.42 (1.33-1.62) (n = 5); 1 preapical antennal seta; L_{pas} 36 (28-46); D_{pd} 158 (149-166); 2 or 3 pedicellar setae ventro-medially; H_{sc} 160-178 (n = 2).

HEAD. — W_h 572 (548-605); dorsal ocular apodeme absent to weak; epistomal suture moderate medially, weak laterally; IOS/side 3 (2-5); postocular setae in uni-

serial row running from near postero-ventral margin of eye dorsally to merge with about 4-5 stronger, longer outer verticals; PtOS/side 8-13; inner verticals reaching to about 0.5 of distance from dorso-medial margin of eye to midline of vertex. Clypeus slightly swollen anteriorly, about as wide as long; CS 9 (5-11). Eyes not hairy, microtrichia appearing as minute spikes antero-medially, not visible laterally; dorso-medial margin extending not quite as far mesad as ventro-medial margin; H_e 278 (245-312). $L_{ps_{2\text{-}5}}:W_{ps_{2\text{-}5}}:MaxL_{pss_{2\text{-}5}}$ 92:34:86, 122:36:70, 131:31:64, 186:28:27; D_{so} 10-16 (n = 2); CP 1.10 (1.08-1.14); palpal stoutness 4.04 (3.83-4.28).

Thorax. — L_{th} 1.24 mm (n = 1), D_{th} 1.31 mm (n = 1). Antepronotum with medial commissure strong, reaching not quite to rear margin of phragma I, slightly surpassing anterior margin of scutal process; antepronotal notch right-angled to very obtuse, with medial corners broadly to very broadly rounded and moderately or only scarcely surpassing scutal process; LAS/side 6-7. Postpronotum without setae and apparently without sensilla(?) on antero-dorsal border. Dorsocentrals uniserial; DCS/side 7 (6-9) (n = 3), $MaxL_{dcs}$ 117-158 (n = 2); PAS/side 4-7; scutellar setae dispersed; ScS 18 (8-28) (n = 5), $MaxL_{scs}$ 150-168 (n = 2); ASR 0.65 (n = 2); 1-3 setae on epimeral II protuberance.

Wing. — L_w 3.0 (2.8-3.3) mm (n = 4), W_w 0.97 (0.95-1.00) mm (n = 4). Dry wing not available. Slide mounted wing showing: costal projection 81 (65-95) (n = 5) or 4.9 (4.1-5.9) times its width. r-m strong, straight or just slightly and fairly uniformly arched; base of r-m distal to apparent m-cu by 1-4 times width of r-m. M_{1+2} weak; apparent m-cu distal to apparent fCu by about 1-2 times width of apparent m-cu; VR 0.90 (n = 2). Remigium (n = 2) with 1 strong seta on hand, 0(?)-1 weak seta and about 6 campaniform sensilla just beyond wrist, and 2-3 setae and 4 large and about 8 smaller campaniform sensilla on distal 0.5 of forearm. Setae 12, 16 on R (n = 2), 7-20 on R_1 (n = 4) and 1-2 on R_{4+5} (n = 4) (uniserial and dorsal on all). Campaniform sensilla 3 ventrally on Sc just beyond arculus, 2 dorsally on R_1, 1 dorsally and 1 ventrally near base of R_{2+3}, and 1-2 dorsally on R_{4+5}. Squama with 23-45 strong setae, $MaxL_{sqs}$ 135-152.

Legs. — $\overline{L}_p:\overline{L}_{tot_{I}}$ not measurable on slides available; Fe I with sparse postero-dorsal beard of about 5 long setae. Apical spur of Ti I long, slender, with only a few short prickles proximally; L_{tispI} 76-90; apical spurs of Ti II stouter, subequal to equal in length, with fairly numerous prickles on basal 0.5; L_{tispII} 45-57; apical spurs on Ti III with numerous prickles on basal 0.4-0.5; $L_{atispIII}$ 43-52, $L_{ptispIII}$ 71-81. Ti III with posterior comb of about 15-17 spines arranged in a fairly regular single row. Spiniform setae on first 3 tarsomeres of P I-III as follows: 0-3, 2 (apical), 0; 9-11, 3-4, 0; 8-12, 4-6, 0. Lengths and ratios of leg segments as follows (n = 2):

	Fe	Ti	Tm_1	$Tm_{2\text{-}5}$	LR	BV	SV
P_I	1180	1340, 1430	920, 1030	910, 960	0.69, 0.72	3.79, 3.80	2.53, 2.73
P_{II}	1260, 1310	1210, 1280	590, 620	760, 740	0.49	4.04, 4.34	4.16, 4.20
P_{III}	1380, 1460	1390, 1560	890, 1060	890, 990	0.64, 0.68	4.11, 4.12	2.86, 3.11

HYPOPYGIUM (without reference to *D. mendotae*). — Fig. 123. Tg IX with 11 (9-14) setae/side. Anal point slender apically, gradually broadening slightly basally, with or without terminal peg; moderate apodemes on underside of Tg IX diverging and arching to antero-lateral corners of Tg IX; L_{gncx} 290-318; L_{tot}:L_{gncx} not measurable. Basal plate weakly developed, with numerous, strong microtrichia ventrally. Medial field well developed, dorsal border weakly delimited; ventro-medial region of medial field strongly produced mesad, this produced region with short, stout setae; distal 0.3 of medial field free, tapering to a point. Aedegal lobes apparently with fine fringe of microtrichia disto-laterally. Gonostylus with subterminal peg and fairly large terminal ridge. Sternapodeme slender, fore margin nearly straight to convex medially. Basal wedge fairly strong, rugose, blunt apically.

DIAGNOSIS. — Antenna plumose, eyes not hairy; the shape of the gonostylus and medial field is similar only to *D. bertrami*, which has hairy eyes.

MATERIAL EXAMINED. — *Alaska,* Anchorage, 24 Sept. 1964, K. Sommerman, jeep trap, 1 male (USNM); Anchorage, Girdwood Hwy., 9-14 July 1964, K. Sommerman, jeep trap, 1 male (USNM); Palmer, 23 Sept. 1964, K. Sommerman, jeep trap, 1 male (USNM); Seward Hwy., Mud.L.-Kenai L.-Summit L., 20 IX 1965, K. M. Sommerman, jeep trap 65-22, 2 males (USNM); *California,* Mono Co., Sonora Pass, Leavitt Creek, el. 8000′, 18 July 1968, leg. R. Hellenthal, light trap, 1 male (UMn); *Greenland,* Etah, 16 August 1908, Peary's North Pole Expedition, 1908, 1 male (USNM); Tasersauk 15/8/1890 ♂ Lundbeck, type, 1 male (MusCopenhaven) (designated lectotype); *East Greenland,* Jameson Land, 4-14.viii..1933, D. Lack, B. M. 1934-233, 1 male (BMNH); *Wyoming,* 44°57′50″N, 109°29′12″W, alt. 10,300′, 31 mi. N, 21 mi. W of Cody, on rocks in small steep stream feeding Frozen Lake, 13 Aug. 1969, leg. D. Hansen, mature male pupa in silk and sand case, with cast larval skin (UMn); 44°57′42″N, 109°29′00″W, alt. 10,300′, 31 mi. N, 21 mi. W of Cody, drift in small stream feeding Frozen Lake, 12-14 Aug. 1969, leg. D. Hansen, 1 mature male pupa (UMn).

DISCUSSION. — *D. chorea* has an interesting history. Lundbeck described it from Greenland, stating that the species is found in both north and south Greenland. He also noted that "the males can be found in the evening in dancing swarms" (translated). Unfortunately, the species is not recognizable from the description. Lundstroem (1918?) figured the hypopygium of a co-type, but the figure is too sketchy to permit a specific determination. Edwards (1933) did only a slightly better job of illustrating the hypopygium of another co-type, and Pagast (1947) didn't illustrate the hypopygium at all. When I first came across specimens of what I thought was *chorea,* I thought there was a reasonable similarity between Edwards' hypopygial figures of *chorea* and *bertrami.* Serra-Tosio (1971: 147), too, notes that he saw no difference between Edwards' drawing of *chorea* and his own of *bertrami* and suggests that Edwards had possibly confused the two species. As it turns out, *chorea* and

bertrami have identical hypopygia, although the eyes in *chorea* are "bare" and those in *bertrami* are "hairy." The difference in eye microtrichia length in these two species is quite striking. I am therefore considering *bertrami* and *chorea* as two distinct species separable (in the adult stage) only on the length of eye microtrichia (which doesn't say much for using this character to separate genera).

I collected a mature male pupa with cast larval skin in its pupal case. The case was constructed of fine sand grains and silk and was from a rock in a very small, steep stream above timber line in the Bear Tooth Mountains (Fig. 30). A mature male pupa was also taken in drift from another small stream in the Bear Tooths (Fig. 31).

The specimen recorded from Oregon as *chorea* by Cole and Lovett (1921) has been seen (CalfInsSur through JES). It is a pinned female, and it seems to be a *Potthastia.*

LOCATION OF TYPES. — Dr. S. L. Tuxen kindly loaned me a slide-mounted specimen of one of Lundbeck's original specimens. It is hereby designated as the lectotype and is labelled as such. It is deposited in the Universitetets Zoologiske Museum, Copenhagen.

Diamesa clavata Edwards

D. clavata Edwards, 1933: 615-616 (described from 6 males, 1 female from Akpatok Island, Hudson Strait; figures hypopygium).

Description (unless otherwise stated, n = 1 and measurements are in microns):

HYPOPYGIUM. — Fig. 121. Tg IX with about 12 setae/side. Anal point fairly slender apically, broadening just slightly basally; strong apodemes on underside of Tg IX diverging and arching to antero-lateral corners of Tg IX. Basal plate well developed, with numerous strong microtrichia ventrally. Medial field well developed, with distal end free. Gonostylus expanded distally, with subterminal peg and strong terminal ridge. Sternapodeme fairly broad medially, slightly produced antero-laterally. Basal wedge fairly strong, blunt apically.

DIAGNOSIS. — Antenna plumose, eyes hairy; basimedial setal cluster absent; medial field well developed; gonostylus somewhat club-shaped. The gonostylus is distinctive.

MATERIAL EXAMINED. — [*North West Territories*], Fly'g over and near stream, valley head, A. K. Gregson, 3 Sept. 1931, O. U. Exp. 1931, S. Akpatok I., Ungava Bay, N. Canada, A. K. Gregson d.d 1931, *Diamesa clavata* Eds., Det. in B. M., F. W. Edwards May 1933, 1 paratype male (Oxford); Damp cleft, gorge cliff, 24 Aug. 1931, O. U. Exp. 1931, SE Akpatok I., Ungava Bay, N. Canada, D. H. S. Davis d.d 1931, *Diamesa clavata* Eds., Det. in B. M., F. W. Edwards May 1933, 1 paratype male (Oxford).

Discussion. — Through the kindness of Dr. G. C. Varley and Mr. E. Taylor, I was able to borrow two paratype males of *D. clavata*. The Oxford Museum preferred that the specimens not be slide mounted, so I simply clipped and cleared the hypopygium and made a temporary glycerine mount of it for the drawing. I could make little note of other characters and have therefore described only the hypopygium.

The gonostylus is unlike any other described species, so determination of this species should be simple.

Location of types. — Holotype and 5 other males are at the Oxford University Museum, Hope Department of Entomology. I saw two of Edwards' specimens.

Diamesa colenae new species

Description (unless otherwise stated, n = 4 and measurements are in microns): as in *D. mendotae* except:

Total length. — 3.8 (3.3-4.1) mm (n = 3) (uncleared alcohol specimens).

Coloration. — not noted.

Antenna (n = 2). — longest flagellar seta 0.65 L_{fl}. Flm_{13} with apical 0.24 spindle-shaped, mainly swollen ventrally; 2-3 short, slender setae dorso- and ventro-medially on Flm_1; long (MaxL 859-900) flagellar setae difficult to count on slides available; setae on basal 0.1-0.2 of spindle-shaped region of Flm_{13}; $\overline{L}_{flm_{1-13}}:\overline{W}_{flm_{1-13}}$ 96:55, 23:48, 27:45, 31:44, 30:40, 34:39, 34:38, 41:35, 41:33, 40:32, 44:32, 826:32; AR 1.56, 1.60; 1 preapical antennal seta, L_{pas} 26, 42; D_{pd} 188; 2-5 pedicellar setae ventro-medially; H_{sc} 203 (188-222) (n = 4).

Head. — W_h 679 (654-728); dorsal ocular apodeme nearly absent to weak but fairly long; epistomal suture (in mature specimens) moderate medially, weak laterally; IOS/side 4.4 (3-6); PtOS/side 10-14; inner verticals reaching to 0.47-0.56 of distance from dorsomedial margin of eye to midline of vertex. Clypeus slightly swollen anteriorly, about as wide as long; CS 17 (13-21) (n = 4). Eyes not hairy, microtrichia visible as minute points antero-medially, not visible laterally; H_e 294, 335 (n = 2); $\overline{L}_{ps_{2-5}}:\overline{W}_{ps_{2-5}}:\overline{MaxL}_{pss_{2-5}}$ 114:40:109, 170:46:97, 170:38:94, 227:33:? (n = 2); D_{so} 17 (16-20); CP 0.99, 1.01 (n = 2); palpal stoutness 4.31, 4.50 (n = 2).

Thorax. — L_{th} 1.31 (1.28-1.36) mm (n = 3), D_{th} 1.28 (1.22-1.33) mm (n = 3). Antepronotum with medial commissure strong, not reaching rear margin of phragma I, reaching to or slightly surpassing anterior margin of scutal process; antepronotal notch varying from right angled, with rounded corners extending well beyond scutal process, to shallow and very obtuse, with medial corners very broadly rounded and scarcely extending beyond scutal process; LAS/side 7-9. Scutal process weak; dorsocentrals uniserial to slightly staggered posteriorly; DCS/side 12 (10-14) (n = 4), $MaxL_{dcs}$ 149-178 (n = 3); PAS/side 9 (6-10); scutellar setae roughly in 2 long posterior and 1 short anterior row; ScS 34 (30-36), MaxL not measurable on slides available. ASR 0.61-0.66 (n = 3); 3-7 setae on epimeral II protuberance.

Wing. — L_w 3.6 (3.4-3.8) mm, W_w 1.13 (1.02-1.22) mm. Dry wing not available. Slide mounted wing showing: costal projection 122 (83-149) or 7.1 (5.3-9.4) times its width. M_{1+2} weak. Remigium with 1-2 strong or 1 strong and 1 or 2

weaker setae on hand, 1 or 2 weak setae and about 8-14 campaniform sensilla just beyond wrist, and 2-3 setae and 4 large and about 8-12 smaller campaniform sensilla on distal 0.5 of forearm. Setae 17 (13-21) on R, 11 (9-14) on R_1, 5 (3-8) on R_{4+5} (uniserial and dorsal on all). Campaniform sensilla 3 ventrally on Sc just beyond arculus, 2-3 dorsally on R_1, 1 dorsally and 1 ventrally near base of R_{2+3}, and 2-4 dorsally on R_{4+5}. Squama with 47-66 strong setae, $MaxL_{sqs}$ 154-198.

LEGS. — (n = 2). $L_{p_I}:L_{tot}$ not measurable in slides available. Fe I with sparse postero-dorsal beard of about 7-8 long setae. Apical spur of Ti I long, slender, with sparse prickles on basal 0.3; apical spurs otherwise as in *D. mendotae*. Spiniform setae on first 3 tarsomeres of P I-III as follows, 2 (apical)-3, 2 (apical), 0; 14, 3-4, 0; 17-20, 7-10, 0. Lengths and ratios of leg segments as follows:

	Fe	Ti	Tm_1	Tm_{2-5}	LR	BV	SV
P_I	1480, 1600	1720, 1900	1190, 1380	1210, 1330	0.69, 0.73	3.63, 3.67	2.53, 2.68
P_{II}	1700, 1720	1600, 1720	760, 890	870, 1010	0.47, 0.52	4.30, 4.63	3.87, 4.36
P_{III}	1860, 1930	1860, 1990	1130, 1460	1180, 1340	0.61, 0.73	4.01, 4.20	2.68, 3.30

HYPOPYGIUM (without reference to *D. mendotae*). — Fig. 122. Tg IX with 16 (12-20) setae/side. Anal point strong, distinctly broadening basally, with short distal keel and small apical peg; strong apodemes on underside of Tg IX fairly straight, diverging and running towards antero-lateral corners of Tg IX; L_{gncx} 388 (365-402); $L_{tot}:L_{gncx}$ 10. Basal plate fairly well developed, slender and quite long, with numerous strong microtrichia ventrally. Medial field well developed, dorsal border rugose, not sharply delimited; medial field with numerous microtrichia, except antero-dorsally, and with numerous setae, particularly antero-ventrally; distal 0.3 of medial field free; medial field with about 6-8 setae in proximo-dorsal corner. Gonostylus slender, with subterminal peg and very short terminal ridge. Sternapodeme slender medially, fore margin straight medially, without antero-lateral projections. Basal wedge fairly strong, triangular, rugose.

DIAGNOSIS. — Antenna plumose, eyes not hairy; basal plate long, slender; medial field long, slender, with free distal end; gonostylus slender. The hypopygial characters are quite distinct.

MATERIAL EXAMINED. — *Alaska,* Anchorage, 24 Sept. 1964, K. Sommerman, jeep trap, 1 male (USNM); *Wyoming,* 44°17'N, 106°57'W, South Fork Campground, 12 mi. W, 5 mi. S of Buffalo, attracted to illuminated sheet by Clear Creek, 23 Aug. 1967, leg. D. Hansen, 1 male (holotype); *Yukon Territory,* Whitehorse, 12.VII.49, L. R. Pickering, 10 males (CNC).

DISCUSSION. — I have collected this species only once; it was attracted to a white sheet hung behind a lantern by a stream. The species is named in honor of my wife, who assisted me very much on our collecting trips and throughout my thesis work.

Location of types. — The holotype is the specimen I collected in Wyoming. It is slide mounted and is deposited in the collection of the Department of Entomology, University of Minnesota, St. Paul, Minnesota. The other specimens examined are designated as paratypes and are returned to their institutions.

Diamesa coquilletti Sublette

Eutanypus borealis Coquillett, 1899: 341-342 (described from 1 male, 1 female from Bering Island, 1 female from Mt. Washington, New Hampshire); Johannsen, 1952: 13 (as junior synonym to *D. nivoriunda* (Fitch)); Sublette and Sublette, 1965: 152 (as junior synonym to *D. nivoriunda* (Fitch)).

[*non*] *Eutanypus borealis* Coq. Coquillett, 1900: 396 (records "a single specimen" from Muir Inlet, Alaska; misdetermination); Cockerell, 1900: 439 (records from New Mexico; misdetermination of *D. heteropus* (Coq.)).

Diamesa coquilletti Sublette, 1966: 584-585 (as new name for *Eu. borealis* Coq.; preoccupied by *borealis* Kieffer, 1915).

Description (unless otherwise stated, n = 1 and measurements are in microns): as in *D. nivicavernicola* except:

Total length. — 5.6 mm.

Coloration. — not noted before slide mounting.

Antenna. — Fig. 41. 8 flagellomeres, with no partial fusion of flagellomeres; non-plumose, longest flagellar seta (on $Flm_{5\ \&\ 7}$) $0.23L_{fl}$; Flm_1 slightly fusiform, with very weak basal nipple; $Flm_{2\text{-}7}$ fusiform, Flm_8 with basal 0.7 cylindrical, apical 0.3 slightly tapering distally; flagellar setae short (MaxL 137), setae 1 on Flm_1, 2 on Flm_2, 3 on $Flm_{3\ \&\ 4}$, 5 on $Flm_{5\text{-}7}$, 1 on Flm_8; single seta at 0.8 of Flm_1 and 0.15 of Flm_8, setae basically in single irregular whorl/flagellomere on $Flm_{2\text{-}7}$; setal whorl at about 0.5 of $Flm_{2\text{-}7}$. Antennal sensilla as follows: large, blunt sensillum basiconicum 1 on $Flm_{1\text{-}5}$; slightly smaller, blunt sensilla basiconica 1 on Flm_1, 2 on Flm_2 (these sensilla on $Flm_{1\ \&\ 2}$ only slightly smaller than the large, blunt sensilla basiconica), 1 on $Flm_{3\text{-}5}$, apparently about 4 on Flm_8 (slightly shorter, blunter, less curved than the numerous long, pointed sensilla basiconica); long, pointed sensilla basiconica 2 on $Flm_{6\ \&\ 7}$, numerous on Flm_8; ringed sensilla coeloconica 2 on $Flm_{1\ \&\ 2}$, 5 on Flm_8; small sensilla coeloconica 2 on Flm_1, 1 on $Flm_{2\ \&\ 3}$, 5 near apex of Flm_8. $\overline{L}_{\underset{1\text{-}8}{flm}} : \overline{W}_{\underset{1\text{-}8}{flm}}$ 105:50, 50:42, 65:34, 55:32, 50:34, 44:34, 44:34, 166:32; AR 0.38; 1 pre-apical antennal seta; L_{pas} about 40; D_{pd} 119; 2 pedicellar setae ventro-medially; scape slightly reduced, with distinct articulation to antennifer ventro-laterally and to pedicel ventro-medially; H_{sc} 125; dorsal or dorso-medial region of scape slightly weaker than remainder.

Head. — W_h 663; coronal suture strong, ending about at level of mid-point of scapes, bifurcating on dorsal region of vertex, with strong coronal apodeme; vertex just slightly sunken at arms of coronal suture; rear margin of coronal triangle produced just slightly dorsad at midline to form very small, weak nape; vertex medially produced towards but not clearly reaching to and fusing with frons, poorly sclerotized between antennal sockets; vertex moderately projecting over dorso-medial

region of each scape; dorsal ocular apodeme absent; reduced ocelli faint, not widely separated, just above projections over scapes; epistomal suture weak medially and laterally; interocular setae at about 0.7 of distance from dorso-medial margin of eye to midline of vertex; IOS/side 1; PtOS/side 13; inner vertical setae not well differentiated from outer verticals, the more dorsal and medial ones being more curved and decumbent, not quite reaching arms of coronal suture dorsally or reaching to 0.56 of distance from dorso-medial margin of eye to midline of vertex. Clypeus slightly swollen anteriorly, wider than long; CS 5. Tentorium slightly swollen antero-laterally just dorsal to its base, not produced postero-medially; tentorium extending slightly beyond PTP. Eyes with dorso-medial margin rounded; H_e 286; ventral ocular apodeme very short, weak; antero-ventral margin of eye not contacting tentorium. PS_1 without setae, roughly globose, slightly less well sclerotized than other palpal segments; distal 0.6 of PS_2 slightly swollen laterally, $PS_{3\text{-}5}$ basically cylindrical; $\overline{L_{ps}}_{2\text{-}5}$: $\overline{W_{ps}}_{2\text{-}5}$: $\overline{MaxL_{pss}}_{2\text{-}5}$ 91:53:75, 115:51:73, 137:42:44, 186:34:46; sunken organ prominent, at 0.8 of PS_3; D_{so} 20; CP 1.23; palpal stoutness 3.00. Cibarial plate about as wide as long, slightly tapering dorsally, with fairly long, tapering cornua. Stipes strong only laterally.

THORAX. — L_{th} 1.56 mm, D_{th} 1.34 mm. Antepronotum with medial commissure reaching only about 0.4 of distance to rear margin of phragma I, reaching to but not surpassing fore margin of scutum; antepronotal notch acute; medial corners rounded, well surpassing anterior margin of scutum; anterior margin of antepronotum straight, not concave antero-laterally; LAS/side 21. Scutum in side view slightly flattened, gently indented approximately above parapsidal suture but not extending anteriorly beyond fore margin of antepronotum. Dorsocentrals uniserial medially and posteriorly, slightly staggered anteriorly; DCS/side 13, 14, $MaxL_{dcs}$ 174. Prealar setae roughly in 1 long, staggered, dorsal and 1 shorter, staggered, ventral row on postero-dorsal region of prealar callus; PAS/side 11; humeral scar a small, tuberose area anterior to dorsal end of parapsidal suture; medial scutal scar not visible in slide available. Scutellar setae roughly in 3 long (posterior) and 1 short (anterior) row; ScS 49, $MaxL_{scs}$ 131. Postnotum with medial cleft reaching to near moderately sharp postero-dorsal corner, with suture on midline postero-ventrally. Anteanepisternal pit ill-defined ventrally; ASR 0.58; 0 setae on epimeral II protuberance, epimeral II protuberance well developed.

WING. — L_w 3.3 mm, W_w not measurable. Wings not fully expanded, so outline indeterminable. Rear margin apparently just slightly concave proximally, anal lobe apparently about right angled. Dry wing not available. Slide mounted wing showing: costal projection apparently about 2 times its width; R_1 apparently not swollen distally; R_{2+3} fairly strong proximally, fading to merely a fold beyond about 0.5 its length, running about midway between R_1 and R_{4+5}; r-m strong, moderately arched; base of r-m scarcely at all distal to apparent m-cu; apparent m-cu distal to apparent fCu by about 3 times width of apparent m-cu; VR 0.95. Remigium with 1 (at least) seta on hand, 2 setae and about 15 campaniform sensilla just beyond wrist, and 4 setae and 3 large and ? smaller campaniform sensilla on distal 0.5 of forearm. Setae 24 on R, 14 on R_1, and 25 on R_{4+5} (uniserial and dorsal on all). Campaniform sensilla not visible on Sc, 0(?) on R_1, 1 dorsally and 1 ventrally near base of R_{2+3}, and about 4 dorsally on R_{4+5}. Squama with about (difficult to count) 34 setae, $MaxL_{sqs}$ not measurable.

Leg. — Only femur and tibia of hind leg present; L_{feIII} 2370, L_{tiIII} 2370; $L_{ptispIII}$ 57; comb of Ti III with 19 spines in regular single row.

Hypopygium (without reference to *D. nivicavernicola*). — Fig. 140. Tg IX with 15, 17 setae/side. Anal point short, slender apically, broadening basally, without apical peg; weak apodemes on underside of Tg IX diverging from base of anal point (difficult to see in slide available); L_{gncx} 548; $L_{tot}:L_{gncx}$ 9. Basal plate apparently well developed. Medial field well developed, dorsal border apparently weak; medial field with microtrichia distally and ventrally, with short, strong setae ventrally; distal 0.2 of medial field slender, free, curving slightly mesad. Gonostylus broadest at 0.3 its length, decreasing abruptly in width, distal 0.5 slender; gonostylus with subterminal peg but apparently without terminal ridge. Sternapodeme fairly broad medially, without antero-lateral projections; fore margin roughly straight. Basal wedge long, strong, rugose.

Diagnosis. — Antenna with 8 flagellomeres; anal point strong; medial field with free distal end. The hypopygium is quite like the European *D. cinerella* (Fig. 141); *cinerella,* however, has 13 flagellomeres.

Material examined. — Bering Island, July-Aug 1897, L. Stejneger, Allotype No. 4047, USNM, allotype male (USNM).

Discussion. — Coquillett (1899) described this species as *Eutanypus borealis* n. gen., n. sp., with a female as the type. "An immature male specimen" from the same locality was also mentioned, and Coquillett further states that a female from Mt. Washington, New Hampshire, was indistinguishable from the Bering Island female. I doubt very much, however, that the specimen from Mt. Washington is actually *D. coquilletti.* A year later Coquillett (1900) recorded the species from Alaska. I saw this specimen (it bore no determination label) in material borrowed from the USNM. It is a female *Diamesa,* but it has bare eyes, so it could not be *coquilletti.* I also saw an undetermined specimen from the USNM labelled "Las Vegas, NM, Cockerell, Collector"; it is a male *D. heteropus* and is possibly the specimen recorded by Cockerell (1900) as *Eutanypus borealis* from New Mexico.

Sublette (1966) recognized his (Sublette and Sublette, 1965) and Johannesen's (1952) earlier incorrect synonymizing of *coquilletti* with *D. nivoriunda.* Sublette (1966) renamed the species in honor of Coquillett (the name is preoccupied by *borealis* Kieffer, 1915) and stated that it most closely resembled *insignipes* Kieffer and *cinerella* Meigen. I don't feel that it shows much similarity to *insignipes,* but it is obviously close to *cinerella* (cf. Figs. 140, 141) and to *ursus* Kieffer (Serra-Tosio, 1971: Pls. 98, 99).

The hypopygium had been slide-mounted, but unfortunately it had been excessively cleared and slightly flattened. I therefore could only

show the more gross features in my figure. I slide mounted the remainder of the male specimen.

The species was collected on Bering Island, one of the Commander Islands, by Dr. L. Stejneger. Bering Island is slightly less than 100 miles from Cape Kamchatka, USSR (Bering Island = 0. Beringa of the Komandorskiye Ostrova, Bartholomew, J., *ed.*, 1959. The Times Atlas of the World. Vol. II. Houghton Mifflin, Boston), and it is in the Pale-artic, not the Nearctic. I didn't realize this until the final stages of this study, so I shall still include *coquilletti* here. It is a palearctic species, however.

LOCATION OF TYPE. — Holotype female and allotype male are at the USNM. I examined the allotype male.

Diamesa davisi Edwards

[?] *D. ursus* Kieffer. Edwards, 1922: 211-212, Fig. 11 (records 3 females from Bear Island; determination questioned by Saether, 1968: 441).

D. davisi Edwards, 1933: 614-615, Fig. 2a (described from 3 males, 1 female from Akpatok Island, Hudson Strait; figures hypopygium).

[*non*] *D. davisi* Edw. Thienemann, 1941: 78; Tabelle 20; 148, 189 (records adults from Swedish Lappland, Norway, and Greenland; records but does not describe pupa); Pagast, 1947: 477-478, 525-526, 573 (description of adult male, male pupa); Thienemann, 1954: 346 (mention of earlier (Thienemann, 1941) records); Saether, 1968: 430, 440, 441-445, 447, 448, 449, 453, 456, 472, 473, 475, 476, 477, 478 (description of larva, pupa, adult from Norway; ecology; zoogeography); Serra-Tosio, 1969: 205, 206 (records from Swedish Lappland, from Brundin collection; questions Thienemann's (1941: 148) records from Greenland); Serra-Tosio, 1971: 195-198, Pls. 82, 155 (description of adult male); Steffan, 1971: 477-478, 483 (records from Northern Scandinavia; ecology in glacial brooks).

Description (unless otherwise stated, n = 5 and measurements are in microns): as in *D. amplexivirilia* except:

TOTAL LENGTH. — 3.2 (3.0-3.4) mm (n = 4).

COLORATION. — not noted.

ANTENNA. — 8 flagellomeres, rarely with partial fusion of Flm$_{2\,\&\,3}$; non-plumose, longest flagellar seta (on Flm$_7$) 0.14-0.16L_{fl}; Flm$_{2\text{-}7}$ slightly to moderately fusiform; flagellar setae short (MaxL 56-78), setae 4-6, 3-4, 1-2, 0-1, 1-3, 0, 4-6, 3-4 on Flm$_{1\text{-}8}$, respectively. Antennal sensilla as follows (n = 3): large, blunt sensillum basiconicum 1 on Flm$_{1\text{-}5}$; smaller, blunt sensillum basiconicum 0-1 on Flm$_1$, 1 on Flm$_2$, 2 on Flm$_3$, 2-4 on Flm$_{4\text{-}5}$, about 3-6 on Flm$_6$, 0-2 on Flm$_7$; long, pointed sensilla basiconica 0-2 on Flm$_5$, 2-4 on Flm$_6$, 15-about 19 on Flm$_7$, numerous on Flm$_8$; ringed sensilla coeloconica 1 dorsal, 1 ventral on Flm$_1$, 1 dorsal on Flm$_2$, occasionally 1 on Flm$_7$, 5-7 on Flm$_8$; small sensilla coeloconica 2 on Flm$_1$, 1-2 on Flm$_2$, 1 on Flm$_3$, 3-4 near tip of Flm$_8$. $\overline{L}_{\mathrm{flm}_{1\text{-}8}}:\overline{W}_{\mathrm{flm}_{1\text{-}8}}$ 98:35, 46:33, 37:31, 29:27,

30:29, 25:28, 39:34, 114:37; AR 0.36 (0.31-0.40); 2 or occasionally 3 weak, curved preapical antennal setae; L_{pas} 24 (20-27); D_{pd} 66 (61-76); pedicellar setae absent; H_{sc} 59 (53-66).

HEAD. — W_h 429 (393-464); coronal suture moderate, ending between top of antennal foramina and lower end of vertex projections over scapes, bifurcating on dorsal region of vertex, with moderate internal apodeme; reduced ocelli very far apart, just above to well above level of tops of antennal sockets; epistomal suture moderate medially, slightly weaker laterally, reaching ATP's; interocular setae easily distinguishable from inner verticals, at or in pair centered at 0.4-0.6 of distance from dorso-medial margin of eye to midline of vertex; IOS/side 1-2; inner verticals not or only occasionally occurring below dorsal margin of eye anteriorly, reaching only 0.33 (0.29-0.36) of distance from dorso-medial margin of eye to midline of vertex; clypeal setae widely separated, located dorso-laterally; CS 2 (0-4). Tentorium not to moderately extending beyond PTP. H_e 215 (203-237). $L_{ps_{2\text{-}5}}:W_{ps_{2\text{-}5}}:MaxL_{pss_{2\text{-}5}}$ 63:40:49, 99:46:43, 81:38:30, 120:32:17; D_{so} 20 (16-28); CP 1.17 (1.11-1.22); palpal stoutness 2.39 (2.12-2.69). Cibarial plate about as high as wide, sides straight or slightly concave, cornua fairly long, slender, slightly arched.

THORAX. — L_{th} 0.89 (0.82-0.94) mm, D_{th} 0.89 (0.75-1.04) mm. Antepronotum apparently without medial commissure (n = 2); antepronotal notch weak, obtuse, apex well behind fore margin of scutum; medial corners broadly rounded, not or only slightly surpassing anterior margin of scutum; LAS/side 10 (about 6-about 15). DCS/side 7 (5-9), $MaxL_{dcs}$ 82 (69-93). Prealar setae confined to postero-dorsal region of prealar callus; PAS/side 3 (2-5); humeral scar a group of 2-5 tubercles anterior to dorsal 0.2 of parapsidal suture. Scutellar setae roughly in 3 rows; ScS about 19 (about 11-30), $MaxL_{scs}$ 89 (75-105). Anteanepisternal pit a small, well to poorly defined oval; medioanepisternum II not completely delimited ventrally, ventral region narrowed, somewhat pointed; ASR 0.54 (0.50-0.56); 0-3 setae on epimeral II protuberance, which is fairly well developed; no setae on epimeron II just below protuberance; 1-2 preepisternal II setae occasionally present just below anapleural suture.

WING. — L_w 2.35 (2.10-2.60) mm, W_w 0.86 (0.73-0.99) mm. Outline about as in Fig. 99. Wing margin usually slightly concave at about 0.5 and just beyond tip of R_1 and at tip of M_{3+4}, straight or just slightly concave just distal to anal lobe; anal lobe quite obtuse. Costal projection 34 (16-50) or 1.6 (0.7-2.5) times its width; vestige of ?R_5 appearing as faint diffuse band just anterior to distal 0.3 of M_{1+2}; vestige of ?M_2 appearing as faint diffuse band just posterior to distal 0.6 of M_{1+2}; VR 0.95 (0.91-1.0). Remigium with 1 or 2 strong setae on hand, 0-1 weak seta and 7-about 12 campaniform sensilla just beyond wrist, and 2-3 setae and 4 large and 4-6 smaller campaniform sensilla on distal 0.5 of forearm. Setae 1-5 on R, 6-9 on R_1, and 7 (4-11) on R_{4+5} (uniserial and dorsal on all) (1 specimen with 1 seta on base of r-m). Campaniform sensilla 0(?)-3 ventrally on Sc just beyond arculus, rarely 1 dorsally on R, 2 on R_1, 1 dorsally near base of R_{2+3}, and 2 (1-4) dorsally on R_{4+5}. Squama with 17 (10-23) setae, $MaxL_{sqs}$ 68 (59-75) (n = 3).

LEGS. — $L_{p_I}:L_{tot}$ 1.51. Apical spur of Ti I rather short, slightly expanded basally, with somewhat sparse to fairly numerous prickles on basal 0.5-0.6; L_{tispI} 33-43; apical spurs of Ti II stouter, subequal, with basal 0.6-0.8 enlarged and bearing fairly numerous prickles; L_{tispII} 31-50; $L_{atispIII}$ 31-43, $L_{ptispIII}$ 60-74. Spiniform

setae on first 3 tarsomeres of P I-III as follows: 2 (apical), 2 (apical), 2 (apical); 5-9, 3-4, 2-3; 16-23, 7-9, 3-4. Tm_4 slightly less cordiform than in *D. mendotae,* with dorso-lateral region only moderately constricted just before apex. Lengths and ratios of leg segments as follows:

	Fe	Ti	Tm_1	Tm_{2-5}	LR	BV	SV
P_I	1570 (1340–1790)	1460 (1260–1610)	920 (790–1010)	890 (770–1000)	0.64 (0.61–0.66)	4.45 (4.17–4.73)	3.27 (3.05–3.44)
P_{II}	1580 (1360–1790)	1310 (1130–1460)	620 (550–710)	660 (570–720)	0.47 (0.43–0.51)	5.36 (4.88–5.92)	4.70 (4.28–5.23)
P_{III}	1680 (1450–1890)	1530 (1310–1660)	1000 (870–1090)	980 (820–1080)	0.65 (0.63–0.67)	4.29 (4.12–4.41)	3.22 (3.10–3.41)

HYPOPYGIUM (without reference to *D. amplexivirilia*). — Fig. 120. Tg IX with 0(?)-about 8 very weak setae/side; St IX with dorso-lateral region slightly produced along side of gonocoxite; projection with several short setae. Anal point absent or only very short, weak, and directed ventrad and only visible in lateral view; apodemes on underside of Tg IX fairly strong, roughly "Y"-shaped. L_{gncx} 335 (281-440), $\bar{L}_{tot}:\bar{L}_{gncx}$ 9. Basal plate fairly well developed, forming a microtrichia and seta-bearing flap-like projection from disto-medial margin of basal foramen. Medial field not developed. Gonostylus broad basally, tapering towards apex, with subterminal peg and toothed terminal ridge. Sternapodeme strongly produced and pointed antero-medially. Basal wedge small, rugose.

DIAGNOSIS. — St IX slightly produced along gonocoxites, anal point absent or very weak, gonostylus fairly evenly tapering distally and usually with distinct terminal teeth. *D. amplexivirilia* is the most similar species but is easily separable with the above hypopygial characters. *D. leona* and *leoniella* lack the terminal teeth and have a "pile" on the medial surface of the gonostylus.

MATERIAL EXAMINED. — *Alaska,* Anchorage, 9 Sept. 1964, K. Sommerman, jeep trap, 1 male (USNM); Anchorage-Eagle R.-L.SusitnaR., 22 Sept. 1966, K. M. Sommerman, jeep trap 66-50, 1 male (USNM); Anchorage-Granite Creek, 8 Sept. 1966, K. M. Sommerman, jeep trap 66-47, 4 males (USNM); Anchorage, Girdwood Hwy. 9-14 July 1964, K. Sommerman, jeep trap, 1 male (USNM); Kenai Pen., Seward-Primrose CG, 17 June 1965, KMSommerman, jeep trap, 1 male (USNM); Matanuska, Eklutna Hwy., 22 June 1964, K. M. Sommerman, jeep trap, 1 male (USNM); Palmer, 23 Sept. 1964, K. Sommerman, jeep trap, 3 males (USNM); Seward Hwy., Mud L.-Kenai L.-Summit L., 20 IX 1965, K. M. Sommerman, jeep trap 65-22, 7 males (USNM); Seward Hwy., Mud L-Summit L. Ldge., 2 Sept. 1965, KMSommerman, jeep trap 65-20, 65-18, 8 males (USNM); Seward Hwy., Summit L., 2 IX 1965, K M Sommerman, jeep trap, 5 males (USNM); Seward Hwy., Summit L.-Portage Glacier, 3 IX 1965 K M Sommerman, jeep trap 65-21, 2 males (USNM); *California,*

Mono County, Sonora Pass, Leavitt Creek, 8,000′, 18 July 1968, leg. Ronald A. Hellenthal, 1 male (UMn); *Montana,* Ft. Peck reservoir, downstream camp over stream, 25 July 1968, leg. Ronald A. Hellenthal, 1 male (UMn); Going to the Sun Hgwy and Logan Ck., light trap, 5,800′, 23 July 1968, Glacier Natl. Park, leg. R. Hellenthal, 13 males (UMn); as above, but drift trap in Logan Creek, 10 males (UMn); *New Hampshire,* Mt. Washington, Ammonoosuc River, 16.VI.1967, leg. D. R. Oliver, DRO 40-13-1, 3 males, 2 pupal exuviae (CNC); [*North West Territories*], Boulders in watercourse, 21 Aug. 1931, O. U. Exp. 1931, S. E. Akpatok I., Ungava Bay, N. Canada, D. H. S. Davis, dd. 1931, det. in BM. F. W. Edwards, May 1933, 1 paratype male (Oxford); *Utah,* Salt Lake County, Big Cottonwood Canyon, mine drain north of road across from Cardiff Fork, leg. A. V. Nebeker, 24 Nov. 1964, 1 male (ANSP); Salt Lake County, Big Cottonwood Creek ½ mile below Mineral Fork, leg. A. V. Nebeker, 12 Dec. 1964, 1 male (ANSP); Salt Lake County, Big Cottonwood Creek ½ mile below Cardiff Fork, leg. A. V. Nebeker, 2 Dec. 1964, 1 male (ANSP); *Washington,* 4 mi. E, 6 mi. S of Glacier, sweeping by meltwater streams by Roosevelt Glacier on Mt. Baker, 4 Sept. 1967, leg. D. Hansen, 3 males (UMn); 3 mi. E, 6 mi. S of Glacier, on rocks in meltwater stream at timberline, Mt. Baker, 7 Sept. 1967, leg. D. Hansen, 4 males (UMn); *Wyoming,* 41°20′N, 106°10′W, 3 mi. NNW of Centennial, by Nash Fork of Little Laramie River, 23 March 1968, leg. D. Hansen, 1 male (UMn); 44°57′42″N, 109°29′00″W, alt. 10,300′, 31 mi. N, 21 mi. W of Cody, under rocks in small rocky stream feeding Frozen Lake, 11, 13 Aug. 1969, leg. D. Hansen, 12 males (UMn); 44°58′26″N, 109°33′12″W, alt. 9,640′, 32 mi. N, 24 mi. W of Cody, on rocks (often congregating) in small stream feeding unnamed lake, water 14°C., 9 Aug. 1969, leg. D. Hansen, 3 males (UMn).

DISCUSSION. — Edwards (1933) described *davisi* from specimens collected by an Oxford University expedition to Akpatok Island in Hudson Strait. The species has not been recorded from the Nearctic since then, although several European workers have described or recorded a species as *"davisi"* from Scandinavia. As discussed below, I do not feel the European species is actually *davisi.*

Thienemann (1941: 189) recorded *"davisi"* from 2 males, a male pupal exuviae, and a male pupa from Abisko, Swedish Lappland. He also stated that the species had been taken at Finse, Norway, and Greenland; neither Serra-Tosio (1971: 197) nor I know how Thienemann (l.c.) got the Greenland record. Pagast (1947: 477-8, Abb. 35-39) described *"davisi"* from the specimens collected by Thienemann. Pagast (l.c.) illustrates the entire hypopygium, the gonostylus, and the anal point, and it seems to me that he was seeing not *davisi* but an undescribed species near *davisi.* The figure by Serra-Tosio (1971: Pl. 82) is like that of Pagast (l.c.). I do not feel that the European species described by Pagast (l.c.) and Serra-Tosio (l.c.) is actually *davisi;* it seems, instead, to be a new species between *amplexivirilia* and what I am calling *davisi.* The ninth sternite in Serra-Tosio's (l.c.) and Pagast's (l.c.) figures approaches the development of that in *amplexivirilia,* and the gonostylus is

also more narrowed at about half its length than in my nearctic specimens of *davisi* (cf. Serra-Tosio, l.c.; Pagast, l.c.; and my Fig. 120). The figure by Saether (1968: Fig. 17c) is of a male prepared from a mature pupa and is not clear enough to compare with other figures.

Near the end of my study I came across specimens of probably two new nearctic species very close to *davisi*. They differ from *davisi* in the shape of the lateral extensions of the ninth sternite and in the shape of the gonostylus. I found them too late to include here, but if we can carefully compare a paratype of *davisi*, the european "*davisi*," the specimens I am calling *davisi*, and these additional species, we will be able to apply the name *davisi* correctly and name and describe the related species.

LOCATION OF TYPES. — Paratypes are at Oxford University; I am not certain, but the holotype is either there or at the BMNH.

Diamesa garretti Sublette and Sublette

D. borealis Garrett, 1925: 6 (described from numerous males and females from British Columbia).

D. garretti Sublette and Sublette, 1965: 151 (as new name for *D. borealis* Garrett; preoccupied by *borealis* Kieffer, 1915); Sublette, 1967a: 296-299, Fig. 2 (lectotype designation; figures hypopygium); Sublette, 1970: 44-46, Fig. 1 (description).

Description (unless otherwise stated, n = 5 and measurements are in microns): as in *D. mendotae* except:

TOTAL LENGTH. — 5.2-5.7 mm (n = 3).

COLORATION (pinned specimen). — capitellum and distal 0.5 of haltere shaft pale white.

ANTENNA. — longest flagellar seta 0.65 (0.63-0.69)L_{fl}; Flm_{13} with apical 0.19-0.22 spindle-shaped, mainly swollen ventrally; 2-5 short, slender setae dorso- and ventro-medially on Flm_1; long (MaxL 900-1000) flagellar setae 1 on Flm_1, 2-3 on Flm_2, 6-8 on Flm_3, 8-10 on Flm_4, increasing to 13-15 on Flm_{12}, numerous on Flm_{13}; setae not on or only on basal 0.1-0.3 of spindle-shaped region of Flm_{13}; $\overline{L}_{flm_{1\text{-}13}} : \overline{W}_{flm_{1\text{-}13}}$ 101:61, 23:50, 26:49, 31:46, 30:44, 30:42, 30:41, 32:41, 35:39, 37:39, 39:38, 42:37, 955:36; AR 1.85 (1.67-1.98); 1 preapical antennal seta, L_{pas} 38 (34-44); D_{pd} 199 (183-215); 2-3 pedicellar setae ventro-medially; H_{sc} 217 (210-222).

HEAD. — W_h 721 (676-748); dorsal ocular apodeme weak; epistomal suture ranging from strong its entire length to moderate medially and weak laterally; IOS/side 4 (2-5); PtOS/side 13-18; inner verticals reaching to 0.64 (0.60-0.68) of distance from dorso-medial margin of eye to midline of vertex. Clypeus moderately swollen anteriorly, as long as or slightly longer than wide; CS 16 (12-21). Eyes not hairy, microtrichia visible antero-medially as minute points, not visible laterally; dorso-medial margin extending not quite as far mesad as ventro-medial margin; H_e 336 (312-350). $\overline{L}_{ps_{2\text{-}5}} : \overline{W}_{ps_{2\text{-}5}} : \overline{MaxL}_{pss_{2\text{-}5}}$ 121:39:95, 178:46:85, 180:37:57, 262:31:32; CP 0.95 (0.88-1.01); palpal stoutness 4.92 (4.73-5.12).

THORAX. — L_{th} 1.50 (1.39-1.60) mm, D_{th} 1.48 (1.44-1.53) mm. Antepronotum with medial commissure strong, not quite reaching rear margin of phragma I, reaching to or slightly surpassing anterior margin of scutal process; antepronotal notch about right-angled, with medial corners rounded and well surpassing scutal process; LAS/side 9 (6-15); postpronotum without setae, but with 0-1 small, indistinct sensilla (?) on antero-dorsal border. Dorsocentrals uniserial to just slightly staggered posteriorly; DCS/side 9 (6-12), $MaxL_{dcs}$ 193 (170-220) (n = 4); PAS/side 9 (7-11); scutellar setae dispersed; ScS about 25-41 (n = 4), $MaxL_{scs}$ 237-284 (n = 3); ASR 0.67 (0.66-0.69); 3-12 setae on epimeral II protuberance.

WING. — L_w 3.9 (3.6-4.1) mm, W_w 1.17 (1.11-1.24) mm. Costal projection 121 (107-137) or 6.7 (6.0-7.5) times its width. Apparent m-cu distal to apparent fCu by about 2-4 times width of apparent m-cu. VR 0.92 (0.90-0.93). Remigium with 1 or 2 strong setae on hand, 1 or 2 weak setae and about 12-15 campaniform sensilla just beyond wrist, and 3 setae and 4 large and 9-10 small campaniform sensilla on distal 0.5 of forearm. Setae 19 (12-24) on R, 11 (8-14) on R_1, and 3 (2-5) on R_{4+5} (uniserial and dorsal on all). Campaniform sensilla 3-4 ventrally on Sc just beyond arculus, 2 dorsally on R_1, 1 dorsally and 1 ventrally near base of R_{2+3}, and 2-4 dorsally on R_{4+5}. Squama with about 40-71 strong setae, $MaxL_{sqs}$ 149-198.

LEGS. — $\bar{L}_{p_I}:\bar{L}_{tot}$ 1.13; Fe I with sparse postero-dorsal beard of about 8-10 long setae. Apical spur of Ti I long, slender, with sparse, short prickles on basal 0.3-0.5; apical spurs otherwise essentially as in *D. mendotae*. Spiniform setae on first 3 tarsomeres of P I-III as follows: 2-6, 2 (apical), 0; 12-15, 5-6, 0; 16-19, 7-10, 0-1 (at about 0.5). Lengths and ratios of leg segments as follows:

	Fe	Ti	Tm_1	$Tm_{2\text{-}5}$	LR	BV	SV
P_I	1569 (1445–1663)	1857 (1646–1994)	1418 (1294–1512)	1381 (1226–1562)	0.77 (0.73–0.79)	3.52 (3.28–3.76)	2.42 (2.34–2.50)
P_{II}	1757 (1613–1893)	1730 (1546–1893)	880 (806–911)	1028 (924–1126)	0.51 (0.48–0.54)	4.25 (4.00–4.43)	3.96 (3.73–4.13)
P_{III}	1989 (1825–2163)	2109 (1927–2298)	1411 (1277–1529)	1361 (1243–1462)	0.67 (0.65–0.70)	4.05 (3.97–4.12)	2.91 (2.78–3.02)

HYPOPYGIUM (without reference to *D. mendotae*). — Fig. 132. Tg IX with 7-11 setae/side. Anal point fairly long, slender, slightly broadening basally, with minute apical peg; strong apodemes on underside of Tg IX diverging from base of anal point and arching to antero-lateral corners of Tg IX; L_{gcx} 313 (304-326); $L_{tot}:L_{gcx}$ 18. Basal plate weakly to moderately developed, with numerous microtrichia ventrally and with disto-medial margin obtuse to right-angled. Medial field well developed, with well-delimited dorsal border and distal end free; medial field with numerous microtrichia and setae, with loose group of fairly stout setae proximo-ventrally. Gonostylus with distal 0.3 much narrower than proximal 0.7, strongly curved, with single subterminal peg and terminal ridge. Sternapodeme a simple arch. Basal wedge short but well developed, rugose.

Diagnosis. — Antenna plumose, eyes not hairy; gonostylus fairly sharply narrowed at about 0.6 its length, distal portion curved. The gonostylus of *garretti* is unlike any other *Diamesa.*

Material examined. — *British Columbia,* Cranbrook, 9.XI, 25.X, 5 males (paratypes and holotype) (CNC); *British Columbia,* Cranbrook, 17.XI, C. B. D. Garrett, 1 paratype male, Cornell paratype no. 2324 (Corn); *British Columbia,* Cranbrook, 9.XI, 2 males (Corn); *British Columbia,* Manning Prov. Park, 8 males, about 20 pupal exuviae (CNC); *Idaho,* Moscow Mt., 6.1.7 (ALMelander collection), 5 males (USNM); *Idaho,* Moscow, J. M. Aldrich, coll., *Diamesa waltlii* Mg, OAJ, 1 male (USNM); *Idaho,* Moscow, Latah Co., XII-17-1960, W. F. Barr, collector, on snow, 1 male (USNM); *Montana,* waterfall in riverlet on E. shore of Flathead Lake, 10 mi NE Polson; 11-VIII-68, leg. J. E. Sublette, 2 male pupae (JES); *Washington,* Bellingham, Whatcom County, 4-16-1964, C. C. Priest, collector, 19 males (UMn, WWSU); *Wyoming,* 44°57′44″N, 109°29′00″W, alt 10,300′, 31 mi. N, 21 mi. W of Cody. Drift in small rocky stream feeding Frozen Lake, 7 PM Aug 13-9AM Aug 14, 1969, leg. Dean Hansen, 1 mature male pupa (UMn); ditto, but on rocks in same stream, 1 mature male pupa (UMn); *Wyoming,* 44°10′N, 107°05′W, Powder River Pass, 18 mi W, 13 mi S of Buffalo, Alt. 9,600′, sweeping in spruce-fir forest 26, 27 Aug. 1967, leg. Dean Hansen, 8 males (UMn).

Discussion. — *D. garretti* was described as *D. borealis* by Garrett (1925) from British Columbia. It remained unrecognizable until Sublette (1967a) redescribed the species from type material purchased from Garrett by the CNC. Sublette (1967a) designated a lectotype from this material, and Sublette (1970) also redescribed some of Garrett's material in the Illinois Natural History Survey. Sublette (1970 and personal communication) had originally thought the Illinois Natural History Survey material represented a second species, but additional specimens from my material convinced him that the apparent differences were largely due to slide mounting variation. If slides are carefully made, the shape of the "subapical lobe" (Sublette, 1970) (= distal end of the medial field) and "basal lobe" (Sublette, 1970) (= proximal end of the medial field) don't vary that much. The shape of the gonostylus, however, can vary quite a bit depending on its orientation (compare my Figs. 132a, b, c; Sublette, 1967a: Fig. 2; and Sublette, 1970: Fig. 1).

Garrett's description does not permit determination of this species. To his credit, however, Garrett had drawn (but not published) an excellent hypopygial figure of "*borealis.*" This figure showed the gonostylus from several aspects and also showed the phallapodeme, sternapodeme, coxapodeme, basal foramen, and aedeagal lobes. It is a shame the figure was not published along with the description, for it could have stimulated other chironomid workers to publish better hypopygial figures. Figures showing the details that Garrett drew weren't commonly published until the 1960's.

Sublette (1967a, 1970) considers that *garretti* is close to *chorea*, however I feel that the medial field and rest of the gonocoxite are closest to *spinacies* and *arctica*.

Location of type. — Lectotype designated by Sublette (1967a) at the CNC. Garrett's holotype was partially slide-mounted and was at the CNC, although it could not be found when Sublette was examining the CNC's material. I examined both the holotype and the lectotype designated by Sublette (1967a).

Diamesa geminata Kieffer

D. geminata Kieffer, 1926: 79-81 (described from male and female from northwestern Greenland): Oliver, 1959: 62 (regards *D. furcata* Edw. as a synonym); Sublette and Sublette, 1965: 151 (as senior synonym to *furcata*).

D. furcata Edwards, 1933: 616, 617-618 (described from 2 males, 7 females from Akpatok Island, Hudson Strait; suggests it may be *Syndiamesa biappendiculata* Goet.); Pagast, 1947: 521-523 (suggests an unknown pupa, *D. spec. I*, could be *furcata*); Oliver, 1959: 62 (as synonym to *geminata*).

D. (*Syndiamesa*) *biappendiculata* Goetghebuer, *in* Remy, 1928a: 52-53. **New synonym.** (Described from 1 male from Jameson Land, East Greenland). Goetghebuer, *in* Remy, 1928b: 90-91 (repeat of above description; figure of hypopygium).

Syndiamesa (*Syndiamesa*) *biappendiculata* Goet. Goetghebuer, 1928: 125-126, Figs. 1, 2 (in key; figure of hypopygium, portion of wing venation); Goetghebuer, 1932 (in key; brief description, figure of hypopygium); Goetghebuer and Lenz, 1939: 5, 6, Fig. 6 (in key; yet another repeat of hypopygium figure, brief description).

Syndiamesa biappendiculata Goet. Thienemann, 1937a: 79 (suggests it may possibly be a Podonominae).

D. biappendiculata Goet. Pagast, 1947: 521-523 (suggests an unknown pupa, *D. spec. I*, could be *biappendiculata*); Sublette and Sublette, 1965: 151 (generic placement).

Description (unless otherwise stated, n = 5 and measurements are in microns): as in *D. mendotae* except:

Total length. — 4.2 (3.7-4.4) mm.

Coloration. — not noted.

Antenna. — longest flagellar seta 0.57-0.59L_{fl} (n = 2); Flm_{13} with apical 0.27-0.30 spindle-shaped, mainly swollen ventrally; 1-2 short, slender setae dorso- and ventro-medially on Flm_1; long (MaxL about 650-670) flagellar setae 0-1 on Flm_1, about 3 on Flm_2, about 7-9 on Flm_3, increasing to about 15 on Flm_{12}, numerous on Flm_{13}; setae on basal 0.1-0.3 of spindle-shaped region of Flm_{13}; $\overline{L_{flm_{1-13}}:W_{flm_{1-13}}}$ 88:49, 22:43, 25:40, 28:37, 27:38, 28:37, 30:37, 33:36, 37:35, 40:34, 41:34, 43:33, 555:32; AR 1.26 (1.18-1.35); 1 preapical antennal seta; L_{pas} 35 (30-38); D_{pd} 153 (137-172); 2-3 pedicellar setae ventro-medially; H_{sc} 152 (137-164).

HEAD. — W_h 538 (499-573); dorsal ocular apodeme absent or nearly so; epistomal suture moderate medially and laterally; IOS/side 2 (1-3); postocular setae running uniserially from near postero-ventral margin of eye dorsally to merge with 3-6 stronger, longer outer vertical setae; PtOS/side about 10-12; inner verticals reaching to 0.46-0.68 of distance from dorso-medial margin of eye to midline of vertex. Clypeus slightly swollen anteriorly, about as long as wide; CS 11 (9-13). Eyes not hairy, microtrichia visible as minute points antero-medially, not visible laterally; dorso-medial margin extending not quite as far mesad as ventro-medial margin; H_e 235 (221-245). $\bar{L}_{ps_{2\text{-}5}} : \bar{W}_{ps_{2\text{-}5}} : \overline{MaxL}_{pss_{2\text{-}5}}$ 95:39:76, 133:41:79, 131:34:60, 190:30:25; D_{so} 16 (12-20); CP 0.97 (0.90-1.02); palpal stoutness 3.86 (3.74-4.09); orifice indistinct.

THORAX. — L_{th} 1.13 (0.97-1.22) mm, D_{th} 0.95 (0.70-1.07) mm. Antepronotum with medial commissure strong, not reaching rear margin of phragma I, reaching to or slightly surpassing anterior margin of scutal process; antepronotal notch right-angled to slightly obtuse, with medial corners rounded and moderately or only weakly surpassing scutal process; LAS/side about 12 (n = 2). Postpronotum without setae and apparently without sensilla(?) on anterodorsal border. Dorsocentrals uniserial; DCS/side 7-10, $MaxL_{dcs}$ 152 (137-166); PAS/side 7-11; humeral scar a very weak, roughened area anterior to dorsal end of parapsidal suture; scutellar setae dispersed; ScS 23-28 (n = 2), $MaxL_{scs}$ about 160. Medioanepisternum II sometimes somewhat poorly delimited postero-ventrally; ASR 0.64 (0.60-0.70); no setae on epimeral II protuberance.

WING (n = 1). — L_w 3.0 mm, W_w 0.95 mm. Rear margin slightly concave proximally, anal lobe about right-angled. Dry wing not available. Slide mounted wing showing: microtrichia visible as numerous, close points at 150×, as very short hair-like projections arising from minute points or dots at 650×. Costal projection 66, or 3.4 times its width; R_1 not enlarged distally; anterior margin of distal 0.2 of R_1 weak; base of r-m distal to apparent m-cu by about 3 times width of r-m; apparent m-cu distal to apparent fCu by about 4 times width of apparent m-cu; VR 0.86. Remigium not easily visible on slides available, only showing 1 strong seta on hand and 2 on distal 0.5 of forearm. Setae 6 on R, 12 on R_1, and 5 on R_{4+5} (uniserial and dorsal on all). Campaniform sensilla 2 (at least — region slightly damaged on slide) ventrally on Sc just beyond arculus, 2 dorsally on R_1, 1 dorsally near base of R_{2+3}, and 1 dorsally on R_{4+5}. Squamal setae impossible to count on slides available.

LEGS. — $\bar{L}_{p_{I}} : \bar{L}_{tot}$ 1.15; Fe I with sparse postero-dorsal beard of about 6-8 long setae. Apical spur of Ti I long, slender, with sparse prickles on basal 0.2-0.4; L_{tispI} 66 (57-76); apical spurs of Ti II stouter, subequal to equal in length, with fairly numerous prickles on basal 0.3-0.4; L_{tispII} 33-55; apical spurs of Ti III with fairly numerous prickles on basal 0.4; $L_{atispIII}$ 38-48, $L_{ptispIII}$ 60-83. Polygon pattern not visible near apex of Ti I. Ti III with posterior comb of about 15-18 spines arranged in a fairly regular single row. Spiniform setae on first 3 tarsomeres of P I-III as follows: 2 (apical), 2 (apical), 1-2 (apical); 7-13, 2-8, 2 (apical); 9-17, 5-8, 2 (apical). Lengths and ratios of leg segments as follows:

	Fe	Ti	Tm_1	$Tm_{2\text{-}5}$	LR	BV	SV
P_I	1330 (1180–1410)	1470 (1280–1650)	1000 (890–1110)	1050 (960–1100)	0.68 (0.67–0.70)	3.63 (3.49–3.82)	2.80 (2.76–2.87)
P_{II}	1380 (1180–1510)	1300 (1100–1510)	670 (570–770)	790 (710–870)	0.52 (0.51–0.52)	4.21 (4.02–4.34)	3.99 (3.91–4.11)
P_{III}	1580 (1330–1790)	1530 (1310–1720)	960 (790–1110)	1000 (720–1130)	0.63 (0.60–0.64)	4.19 (3.82–4.75)	3.29 (3.18–3.35)

HYPOPYGIUM (without reference to *D. mendotae*). — Fig. 124. Tg IX with 18 (13-26) setae/side. Anal point short, strong, quite broad, with several tubercles distally and small terminal peg; strong apodemes on underside of Tg IX diverging and arching slightly to antero-lateral corners of Tg IX; L_{gncx} 357 (325-374); $\overline{L}_{tot}$: $\overline{L}_{gncx}$ 12. Basal plate scarcely developed, about right-angled disto-medially. Medial field fairly well developed, with dorsal border not sharply delimited; medial field with numerous microtrichia, with setae particularly strong antero-ventrally; distal end of medial field just barely free. Gonostylus bifed, with dorsal fork slightly longer than ventral fork; ventral fork with subterminal peg and short terminal ridge, dorsal fork tapering distally. Sternapodeme broadest medially, like a truncated triangle. Basal wedge strong, broad, rugose, bluntly pointed.

DIAGNOSIS. — Anal point short, very broad; gonostylus forked. No other nearctic species has a forked gonostylus. ("*Diamesa*" *appendiculata* Lundstroem has a forked gonostylus, but it is not a true *Diamesa*).

MATERIAL EXAMINED. — Greenland, Etah, 8.13.08, Peary's North Pole Exp. 1908, 2 males (USNM); [*North West Territories*], ND 9-1, C. Skogn Highland, 25.VIII.60, Devon Island Exp., coll. D. R. Oliver, 10 males (CNC); Flying swarm, over scree, in ravine, D. H. S. Davis, 14 Sept. 1931, O. U. Exp. 1931, S. E. Akpatok I., Ungava Bay, N. Canada, D. H. S. Davis, d.d 1931, *Diamesa furcata* Eds. det. in B. M. May 1933, 1 paratype male (Oxford); as above, but 3 females (Oxford).

DISCUSSION. — Kieffer (1926) described *geminata* from a male and a female collected by the Second Norwegian Arctic Expedition in the "Fram" at "Reindeerpoint." Reindeer Point is a small point extending into Foulke Fjord on the northwest coast of Greenland (78°20′ N. lat.). Oliver (1959) examined the holotype of *geminata* at the Zoological Museum, Oslo, and synonymized *furcata* Edw. with *geminata*. I examined one of Edwards' paratypes of *furcata* and agree with Oliver's synonymy. Goetghebuer (*in* Remy, 1928a) described *D. biapendiculata* from East Greenland, stating that the fourth tarsomere was cylindrical, although shorter than the fifth. I think Goetghebuer simply erred in this observation, for the fourth tarsomere in *geminata* is cordiform, and the hypopygial figure drawn by Goetghebuer is clearly that of *geminata*.

LOCATION OF TYPE. — The holotype of *geminata* is at the Zoological Museum, Oslo (Kieffer, 1926; Oliver, 1959); I did not examine the holotype.

Diamesa gregsoni Edwards

D. gregsoni Edwards, 1933: 618 (described from 1 male, 1 female from Akpatok Island, Hudson Strait); Serra-Tosio, 1967c: 93-96 (records from Norway; description and figure of hypopygium of male); Serra-Tosio, 1969a: 205, 206 (records same male as above, from Brundin collection); Serra-Tosio, 1971: 145-147, Figs. 55.1 & 2, 152 (description, figure of hypopygium of male).

Description (unless otherwise stated, n = 3 and measurements are in microns): as in *D. mendotae* except:

TOTAL LENGTH. — 4.6 mm (n = 1) (uncleared specimen in alcohol).

COLORATION. — not noted.

ANTENNA. — longest flagellar seta 0.65-0.68L_{fl}; Flm_{13} with apical 0.22-0.24 spindle-shaped, mainly swollen ventrally; 2-3 short slender setae dorso- and ventro-medially on Flm_1; long (MaxL 793-883) flagellar setae 1 on Flm_1, 2 on Flm_2, 8 on Flm_3, about 10-11 on Flm_4, increasing to 13-14 on Flm_{12}, numerous on Flm_{13}; setae only on basal 0.1-0.2 of spindle-shaped region of Flm_{13}; spindle-shaped region of Flm_{13} with numerous slender, pointed sensilla basiconica, apparently 0 or only 2 similar but blunter, shorter sensilla basiconica arising from more distinct pits than the preceding, and 5-6 ringed sensilla coeloconica; $L_{flm_{1-13}}:W_{flm_{1-13}}$ 96:56, 21:49, 24:47, 29:43, 28:42, 29:41, 32:41, 33:40, 38:40, 37:40, 41:39, 41:39, 728:37; AR 1.38-1.40; 1 preapical antennal seta; L_{pas} 47 (46-48); D_{pd} 176 (172-182); 2-3 pedicellar setae ventro-medially; H_{sc} 188-192.

HEAD. — W_h 701 (663-736); epistomal suture moderate to weak medially, weak to absent laterally; IOS/side 5 (3-6); PtOS/side 13-17; inner verticals reaching to 0.57 (0.54-0.63) of distance from dorso-medial margin of eye to midline of vertex. Clypeus slightly swollen anteriorly, about as wide as long; CS 18 (15-22). Eyes not hairy, microtrichia visible antero-medially as minute points, not visible laterally; dorso-medial margin extending not quite as far mesad as ventro-medial margin; H_e 313 (294-327). $\overline{L_{ps_{2-5}}:W_{ps_{2-5}}}:MaxL_{pss_{2-5}}$ 106:41:92, 168:49:80, 172:39:79, 235:35:32; D_{so} 14-16; CP 1.02 (1.00-1.06); palpal stoutness 4.16 (3.85-4.54).

THORAX. — L_{th} 1.53 mm, D_{th} 1.46 mm (n = 1). Antepronotum with medial commissure strong, not quite reaching rear margin of phragma I, reaching to or slightly surpassing anterior margin of scutal process; antepronotal notch about right-angled, with medial corners rounded and well surpassing scutal process; LAS/side about 12 (n = 1). Postpronotum without setae and apparently without small sensilla(?) on antero-dorsal border; dorsocentrals uniserial; DCS/side 11 (10-12) (n = 3), $MaxL_{dcs}$ 164 (n = 1); PAS/side 13 (10-15) (one specimen with 2 clear campaniform sensilla just before and above prealar setae); scutellar setae dispersed or very roughly in 3 rows; ScS 36-42 (n = 3), $MaxL_{scs}$ about 230 (n = 1); ASR 0.64 (0.63-0.67); 5-7 setae on epimeral II protuberance.

WING. — L_w 3.3-3.5 mm, W_w 1.07-1.17 mm. Dry wing not available. Slide

mounted wing showing: Costal projection 73-119, or 4.6-6.0 times its width; Sc as in *D. mendotae* except not quite reaching C. VR 0.91-0.93. Remigium with 1 strong seta on hand, 1-3 weak setae and about 5-8 campaniform sensilla just beyond wrist, and 4 setae and 4-5 large and about 6-9 smaller campaniform sensilla on distal 0.5 of forearm. Setae 17-19 on R, 10-14 on R_1, and 4-11 on R_{4+5} (uniserial and dorsal on all). Campaniform sensilla 3 ventrally on Sc just beyond arculus, 2 dorsally on R_1, 1 dorsally and 0 or 1 or 1 small seta ventrally near base of R_{2+3}, and 3-4 dorsally on R_{4+5}. Squama with about 45-76 strong setae, $MaxL_{sqs}$ 149-186.

LEGS. — $\bar{L}_{p_I} : \bar{L}_{tot}$ not measurable on slides available; Fe I with sparse postero-dorsal beard of about 7 long setae. Apical spur of Ti I long, slender, with sparse prickles on basal 0.3-0.4; apical spurs of Ti II stouter, subequal in length, with fairly numerous prickles on basal 0.5; apical spurs otherwise essentially as in *D. mendotae.* Polygon pattern on Ti III well developed. Spiniform setae on first 3 tarsomeres of P I-III as follows: 2 (apical), 2 (apical), 0; 11-13, 2 (apical)-4, 0; 15-20, 8-9, 0. Lengths and ratios of leg segments as follows:

	Fe	Ti	Tm_1	Tm_{2-5}	LR	BV	SV
P_I	1410–1530	1680–1800	1260–1350	1260–1310	0.75–0.76	3.45–3.66	2.45–2.46
P_{II}	1630–1710	1580–1700	820–860	960–990	0.51–0.52	4.14–4.35	3.90–3.98
P_{III}	1760–1930	1840–2030	1300–1400	1280–1380	0.68–0.70	3.83–3.96	2.78–2.87

HYPOPYGIUM (without reference to *D. mendotae*). — Fig. 139. Tg IX with 12-14 setae/side. Anal point fairly long, slender distally but broadening basally, with minute apical peg; strong, slightly arched apodemes on underside of Tg IX diverging from base of anal point, running to antero-lateral corners of Tg IX. L_{gncx} 356-379; $\bar{L}_{tot}:\bar{L}_{gncx}$ 13. Basal plate moderately developed, with numerous microtrichia ventrally. Medial field well developed, with dorsal border somewhat rugose, not sharply delimited; medial field with numerous microtrichia and setae, setae particularly strong antero-ventrally; distal end of medial field free, disto-dorsal corner produced dorsad to form a flap. Gonostylus of fairly equal width throughout, gently arched, with subterminal peg and short terminal ridge. Sternadopeme fairly broad medially, with fore margin nearly straight or slightly concave medially. Basal wedge short but well-developed, rugose.

DIAGNOSIS. — Antenna plumose, eyes not hairy; medial field with disto-dorsal margin produced flap-like.

MATERIAL EXAMINED. — [*New Brunswick*], Camp Adams, Northumb. Co., N. B., 8-IV-1962, J. Marshall, 4 males, several females (CNC); [*North West Territories*], Akpatok Island, flying over and near stream, valley head, 3.IX.31, Gregson, holotype male (BM(NH)).

DISCUSSION. — *D. gregsoni* was described from Akpatok Island, Hud-

son Strait; the only additional specimens I have seen were from New Brunswick. Serra-Tosio (1967c) recorded it from the Palaearctic.

LOCATION OF TYPES. — Holotype male at the BM(NH), allotype female at Oxford University. Mr. A. M. Hutson kindly loaned me the holotype for examination, and Dr. G. C. Varley and Mr. E. Taylor kindly loaned me the allotype female.

Diamesa haydaki new species

Description (unless otherwise stated, n = 5 and measurements are in microns): as in *D. mendotae* except:

TOTAL LENGTH. — 4.7 (4.3-5.1) mm.

COLORATION (pinned specimen). — about as in *D. mendotae* (n = 1).

ANTENNA. — longest flagellar seta 0.63 (0.56-0.69)L_{fl}; Flm_{13} with apical 0.19-0.24 spindle-shaped, mainly swollen ventrally; 2-3 short, slender setae dorso- and ventro-medially on Flm_1; long (MaxL 1145-1358) flagellar setae 1 on Flm_1, 3-4 on Flm_2, 7-10 on Flm_3, 9-12 on Flm_4, increasing to 14-15 on Flm_{12}, numerous on Flm_{13}; setae on basal 0.1-0.3 of spindle-shaped region of Flm_{13}; $\overline{L}_{flm_{1-13}} : \overline{W}_{flm_{1-13}}$ 90:56, 24:48, 25:48, 27:44, 26:43, 27:43, 29:44, 30:45, 33:44, 34:43, 36:41, 37:40, 772:39; AR 1.66 (1.41-1.76); 1 preapical antennal seta; L_{pas} 37 (27-49); D_{pd} 180 (168-188); pedicellar setae absent; H_{sc} 200 (180-218).

HEAD. — W_h 676 (645-717); dorsal ocular apodeme short to very long, in the latter case extending parallel to top of antennal socket about 0.75 of distance to coronal suture; epistomal suture varying from strong medially, weak laterally, to moderate medially, absent laterally; IOS/side 3 (2-4); rarely with a pair of medial vertex setae; PtOS/side about 7-11; inner vertical setae few (5-7), confined almost to dorsal-most region of vertex; inner verticals reaching to 0.46 (0.41-0.50) of distance from dorso-medial margin of eye to midline of vertex. Clypeus slightly swollen anteriorly, about as wide as long; CS 12 (10-16). Eyes hairy, microtrichia 1.5-2 times height of ommatidial lenses; dorso-medial margin of eye ranging from truncate, with dorsal corner rounded, to more rounded, with dorsal corner and dorso-medial margin merging in single broad curve; dorso-medial margin not extending as far mesad as ventro-medial margin; H_e 300 (284-312); antennifer weak. $\overline{L}_{ps_{2-5}} : \overline{W}_{ps_{2-5}}$ 90:30, 150:44, 151:35, 224:30 (most setae on palpi were broken off, so they were not measured); D_{so} 16 (14-20); CP 1.11 (1.08-1.17); palpal stoutness 4.16 (3.94-4.50).

THORAX. — L_{th} 1.35 (1.29-1.42) mm, D_{th} 1.28 (1.22-1.38) mm. Antepronotum with medial commissure strong, not quite reaching rear margin of phragma I, not surpassing scutal process; LAS/side 10 (8-13); postpronotum without setae, but with 1-2 faint sensilla(?) on antero-dorsal border. Dorsocentrals uniserial to slightly staggered posteriorly; DCS/side 6 (3-9), $MaxL_{dcs}$ 132 (99-152); PAS/side 7 (4-10); scutellar setae dispersed or roughly in 2 rows; ScS about 14-24 (difficult to count in slides available), $MaxL_{scs}$ 140-170 (n = 3); ASR 0.69 (0.68-0.70); 0-5 setae on epimeral II protuberance.

WING. — L_w 3.1 (2.8-3.4) mm, W_w 0.97 (0.82-1.05) mm. Costal projection 127 (109-139) or 6.6-7.9 times its width; apparent m-cu distal to apparent fCu by

about 2-3 times width of apparent m-cu; VR 0.94 (0.93-0.95). Remigium with 1 strong seta on hand, 0-1 weak seta and about 6-12 campaniform sensilla just beyond wrist, and 2-3 setae and 4 large and about 9 smaller campaniform sensilla on distal 0.5 of forearm. Setae 4-6 on proximal 0.4-0.6 of R, 5-9 on R_1, and 2-5 on R_{4+5} (uniserial and dorsal on all). Campaniform sensilla 2-3 ventrally on Sc just beyond arculus, 1-2 dorsally on R_1, 1 dorsally and 1 (rarely 0) ventrally near base of R_{2+3}, and 2-5 dorsally on R_{4+5}. Squama with 42-46 strong setae, $MaxL_{sqs}$ 115-150; 1 specimen with 1 short seta on alula.

Legs. — $\bar{L}_{p_I}:\bar{L}_{tot}$ 1.10; Fe I without visible beard in slides available. Apical spur of Ti I long, slender, with only a few prickles on basal 0.3; L_{tispI} 72 (67-76); apical spurs of Ti II stouter, subequal to equal in length, with fairly numerous prickles on basal 0.4-0.5; apical spurs of Ti III with fairly numerous prickles on basal 0.4-0.5; $L_{atispIII}$ 56 (52-60), $L_{ptispIII}$ 78 (69-90). Ti III with posterior comb of about 14-17 spines arranged in a fairly regular single row. Spiniform setae on first 3 tarsomeres of P I-III as follows: 2 (apical)-8, 0-2 (apical), 0; 10-13, 3-5, 0; 12-15, 5-9, 0-2 (at about 0.6). Lengths and ratios of leg segments as follows:

	Fe	Ti	Tm_1	Tm_{2-5}	LR	BV	SV
P_I	1320 (1180–1500)	1580 (1410–1760)	1120 (990–1260)	1150 (1030–1270)	0.71 (0.70–0.72)	3.50 (3.40–3.58)	2.58 (2.53–2.61)
P_{II}	1420 (1240–1580)	1410 (1260–1560)	710 (620–840)	860 (770–990)	0.50 (0.47–0.54)	4.11 (4.00–4.25)	4.00 (3.74–4.14)
P_{III}	1600 (1430–1760)	1720 (1510–1890)	1060 (940–1240)	1130 (1010–1280)	0.62 (0.60–0.66)	3.89 (3.74–4.06)	3.13 (2.94–3.26)

Hypopygium (without reference to *D. mendotae*). — Fig. 119. Tg IX with 12 (9-15) setae/side. Anal point strong, fairly slender, broadening just slightly basally, with short apical peg; moderate apodemes on underside of Tg IX diverging slightly, then arching to antero-lateral corners of Tg IX; L_{gncx} 293 (276-304), $\bar{L}_{tot}:\bar{L}_{gncx}$ 16. Basal plate scarcely developed. Medial field well developed, dorsal border well delimited; medial field with numerous microtrichia and setae; distal end of medial field broad, free. Basimedial setal cluster with fairly numerous long, strong setae directed antero-mesad. Gonostylus broadest at 0.5, with subterminal peg and very short terminal ridge. Sternapodeme fairly slender medially, with weak antero-lateral projections; fore margin fairly straight medially. Basal wedge very broad, triangular, weakly rugose.

Diagnosis. — Antenna plumose, eyes hairy, basal plate scarcely developed, basimedial setal cluster strong.

Material examined. — *Arizona,* Southwest Research Station, Cochise Co., 5400′, 5 mi W. Portal, 15-20-III 1966, 3 males (JES); *Colorado,* Ft. Collins, VI.12. 41, light trap, M. A. Palmer, 1 male (ColStU); *Minnesota,* Rock Co., Steen, N. J. Mosquito trap, 1 May 1968, leg. E. F. Cook, 2 males (UMn); *Wyoming,* Laramie,

2, 3, 17 June 1947, light trap, 4 males (UWyo); Laramie, 25, 26 June 1947, D. G. Denning, collector, light trap, 2 males (UWyo); Powder River Pass, 40°10′N, 107° 05′W, 18 mi W, 13 mi. S of Buffalo, alt. 9600′, sweeping in spruce-fir forest, 26, 27 Aug 1967, leg. D. Hansen, 2 males (UMn).

Discussion. — *D. haydaki* is interesting for its distribution. The Minnesota record is in the former prairie region, i.e., flat terrain and few trees. The location near Powder River Pass in Wyoming, however, is at 9,600′ and is near timber line. Only *heteropus* has a similar distribution. *D. haydaki* is also interesting in consistently lacking setae on the pedicel.

The species is named in honor of the late Dr. Mykola H. Haydak, who was so kind and helpful to me in getting me interested and started in beekeeping.

Location of types. — Holotype is the specimen collected by me 27 Aug. 1967 at Powder River Pass, Wyoming (slide DH69-261). The other specimens examined are designated paratypes and are returned to their respective museums, while the holotype is deposited in the Entomology Collection of the Department of Entomology, University of Minnesota, St. Paul.

Diamesa heteropus (Coquillett)

Eutanypus borealis Coquillett. Cockerell, 1900: 439 (misdetermination).

Tanypus heteropus Coquillett, 1905: 66 (described from 9 males, 1 female, from Washington, New Mexico, New Hampshire; series was probably mixed).

Protanypus heteropus Coquillett. Johannsen, 1908: 271 (generic placement).

Adiamesa confusa Garrett, 1925: 5-6. **New synonym.** (Described from 1 male from British Columbia).

Podonomus confusus (Garrett). Sublette and Sublette, 1965: 150 (generic placement).

Diamesa banana Garrett, 1925: 6 (described from 2 males from British Columbia); Roback, 1957a: 6 (reproduces manuscript drawing by Garrett of hypopygium of *D. banana*); Sublette, 1967a: 294-296 (review of type; as new synonym to *D. heteropus* (Coq.)). Saether, 1969: 21-23 (figure of hypopygium; regards as valid species).

D. onteona Roback, 1957a: 6-7, 20 (described from 1 male from Utah; figures Tm_{4+5}, hypopygium. **New synonym.**

D. heteropus (Coquillett). Johannsen, 1952: 13 (as a junior synonym to *D. nivoriunda* (Fitch)); Sublette, 1966: 545-586 (redescription of holotype; figure of hypopygium).

Description (unless otherwise stated, n = 5 and measurements are in microns): as in *D. mendotae* except:

Total length. — 5.1 (4.1-5.9) mm (n = 6).

Coloration (pinned specimen). — about as in *D. mendotae* (Mutt.).

Antenna. — longest flagellar seta 0.61 (0.58-0.66)L_{fl}; Flm_{13} with apical 0.24-0.27 spindle-shaped, mainly swollen ventrally; 2-3 short, slender setae dorso- and

ventro-medially on Flm_1; long (MaxL 720-818) flagellar setae 1 on Flm_1, 3-4 on Flm_2, 6-9 on Flm_3, 10-11 on Flm_4, increasing to 13-15 on Flm_{12}, numerous on Flm_{13} (n = 3); setae on basal 0.3 of spindle-shaped region of Flm_{13}; spindle-shaped region of Flm_{13} with numerous slender, pointed sensilla basiconica arising from little or no pit, several similar sensilla arising from distinct pits, and 5-6 ringed sensilla coeloconica (n = 3); $\overline{L}_{flm_{1\text{-}13}} : \overline{W}_{flm_{1\text{-}13}}$ 92:55, 25:49, 28:48, 30:45, 30:42, 32:42, 34:42, 37:42, 42:41, 42:41, 44:39, 46:38, 709:38; AR 1.31 (1.26-1.41); L_{pas} 40 (36-42); D_{pd} 175 (164-184); 2-3 pedicellar setae ventro-medially; H_{sc} 197 (174-220).

HEAD. — W_h 712 (630-769); dorsal ocular apodeme fairly strong; epistomal suture ranging from moderate all the way across to strong medially, weak laterally; IOS/side 3 (2-4); inner verticals reaching to 0.49 (0.44-0.56) of distance from dorso-medial margin of eye to midline of vertex. Clypeus slightly swollen anteriorly, as wide as long or slightly wider than long; CS 15 (8-23); dorso-medial margin of eye not extending as far mesad as ventro-medial margin; H_e 298 (270-319); $\overline{L}_{ps_{2\text{-}5}} : \overline{W}_{ps_{2\text{-}5}} : \overline{MaxL}_{pss_{2\text{-}5}}$ 103:40:85, 151:48:69, 152:39:57, 225:32:33; CP 1.12 (1.06-1.18); palpal stoutness 3.99 (3.77-4.55).

THORAX. — L_{th} 1.47 (1.14-1.70) mm, D_{th} 1.39 (1.09-1.58) mm (n = 6). Antepronotum with medial commissure not reaching rear margin of phragma I, reaching to or slightly surpassing scutal process; antepronotal notch varying from acute, with rounded corners, to very short and about right-angled; LAS/side 13 (8-17). Postpronotal apophyseal pit small, faint, rarely double; postpronotal apophyses weak. Dorsocentrals uniserial or slightly staggered posteriorly; DCS/side 10 (7-12), $MaxL_{dcs}$ 160 (135-198); PAS/side 9 (5-13); humeral scar a roughened or tuberous irregular area at dorsal end of parapsidal suture; scutellar setae roughly in three rows; ScS 29 (20-44), $MaxL_{scs}$ 205 (158-238); ASR 0.68 (0.66-0.69); 1-5 fine setae on epimeral II protuberance.

WING. — L_w 3.5 (3.1-3.9) mm, W_w 1.18 (1.05-1.28) mm. Costal projection 103 (89-119) or 3.8-6.0 times its width; apparent m-cu distal to apparent fCu by about 2-4 times width of apparent m-cu; VR 0.94 (0.91-0.98). Remigium with 1 strong seta on hand, 0-1 weak seta and about 12-16 campaniform sensilla just beyond wrist, and 2-4 setae and 4 large and about 6-10 smaller campaniform sensilla on distal 0.5 of forearm. Setae 13 (11-16) on R, 9 (8-11) on R_1, 9 (6-13) on R_{4+5} (uniserial and dorsal on all). Campaniform sensilla 2-3 ventrally on Sc just beyond arculus, 2-3 dorsally on R_1, 1 (rarely 0) dorsally and 1 ventrally near base of R_{2+3}, and 3-5 dorsally on R_{4+5}. Squama with 32-60 strong setae, $MaxL_{sqs}$ 129-194.

	Fe	Ti	Tm_1	$Tm_{2\text{-}5}$	LR	BV	SV
P_I	1500 (1310–1650)	1830 (1560–2030)	1300 (1080–1450)	1340 (1180–1460)	0.71 (0.69–0.73)	3.46 (3.32–3.56)	2.56 (2.51–2.67)
P_{II}	1640 (1400–1830)	1620 (1390–1790)	790 (660–890)	970 (860–1080)	0.49 (0.47–0.50)	4.14 (4.02–4.25)	4.15 (4.06–4.31)
P_{III}	1830 (1600–2030)	1970 (1680–2160)	1300 (1060–1510)	1300 (1150–1510)	0.67 (0.60–0.70)	3.90 (3.71–4.03)	2.93 (2.71–3.14)

LEGS. — $\overline{L}_{p_I}:\overline{L}_{tot}$ 1.17; Fe I with very sparse postero-dorsal beard of about 1-4 long setae. L_{tispI} 64-76; apical spurs otherwise essentially as in *D. mendotae.* Spiniform setae on first 3 tarsomeres of P I-III as follows: 2 (apical)-3, 2 (apical), 0; 9-15, 3-5, 0; 13-23, 5-10, 0-1 (at about 0.5-0.7). Lengths and ratios of leg segments, p. 96.

HYPOPYGIUM (without reference to *D. mendotae*). — Fig. 113. Tg IX with 7 (3-10) setae/side. Anal point short, slender, pointed, gradually broadening basally, apparently with small, pointed terminal peg; weak to moderate apodemes on underside of Tg IX diverging only slightly and running to and then along fore margin of Tg IX; L_{gncx} 298 (271-318); $L_{tot}:L_{gncx}$ 17. Basal plate scarcely developed but with coarse microtrichia ventrally. Medial field well developed, well sclerotized, with dorsal border poorly delimited; mesal surface of medial field flat and vertical, with numerous microtrichia and setae, setae particularly strong disto-ventrally; distal 0.3 of medial field free. Basimedial setal cluster located beneath medial field, with numerous very long, strong setae directed antero-mesad. Gonostylus broadest at basal 0.2, tapering distally; gonostylus with subterminal peg and only short, very weak terminal ridge. Sternapodeme fairly slender medially, broader antero-laterally, with fore margin fairly straight. Basal wedge short but strong, rugose.

DIAGNOSIS. — Antenna plumose, eyes hairy; anal point fairly short; basimedial setal cluster located below medial field; medial field flat, vertical medially.

MATERIAL EXAMINED. — *Alaska,* Anchorage-Eklunta Flats, 2 Sept. 1966, K. M. Sommerman, jeep trap 66-46, 1 male (USNM); Tamnak Valley, Attu. [island at western end of Aleutians], III-12-45, flying on snow, 0°C, A. Bajkov, 1 male (USNM); UmnakId [Umnak Island, one of the Fox Islands in the Aleutians], 24-VI-1945, RW Drabble, 1 male (USNM); [*Washington*], Columbia R., 10-IV-1962, about 6 males, several pupal exuviae (CNC); Columbia R., Hampton Brantford Co., 7.II. 1962, 6.III.1952, 12 pupal exuviae (CNC); Columbia R. 24.VI.1952, 2 pupae (CNC); Columbia R., Hanford, Benton County, 2-I-52, 2 males not completely emerged from pupae (CNC); Columbia R., Hantford Benton Co., 2 Jan. 1952, several males and pupal exuviae (CNC); [*British Columbia*], Cranbrook, June, male holotype of *Adiamesa confusa* Garrett (CNC); Cranbrook, 12.VIII, C. B. D. Garrett, lectotype of *D. banana* Garrett (CNC); Roadside stream near Bonnington Falls, Nelson, B. C., 25.V.1964, G. C. and D. M. Wood, 1 male (CNC); *California,* Convict Creek, Mono County, 7,200′, 17-VII-1963, leg. H. D. Kennedy, light trap, 1 male (JES); Inyo Co., Bennetts Well, III.30.1954, A. E. Michelbacher, collector, 1 male (CalifInsSur); Mono County, Sonora Pass, Leavitt Creek, elv. 8,000′, 18 July 1968, leg. Ronald Hellenthal, light trap, 1 male (UMn); *Colorado,* Ft. Collins, 3-24-03, 1 male (ColStU); 38°31′N, 106°08′W, 3.5 mi. W of Poncha Springs, sweeping under bridge over Little Arkansas River, 11 Dec. 1968, leg. D. Hansen, 2 males (UMn); *Idaho,* Craters of the Moon Nat. Mon., 5 July 1965, attracted to black light, D. S. Horning, Jr., collector, 362, 1 male (USNM); Latah Co., Trails Pond, found on ice and snow, 7 March 1969, J. M. Gillespie, 5 males (UMn, UtStU); Lemhi Co., Texas Creek, Hwy. 28, 2 miles south of Leadore, 7 March 1965, leg. A. V. Nebeker, 1 male (ANSP); Moscow, 17 Dec. 1961, W. F. Barr, on snow, *Diamesa onteona*

Roback [det. ?], 1 male (USNM); Moscow Mt., 6.1.7, ALMelander collection, 1961, 2 males (USNM); Power Co., 2 mi. W Massacre Rocks II-4-1966, on snow, W. F. Barr, collector, 16 males (UtStU); Twin Falls, Pole 27, trap 2, 16 April 1932, wind vane trap, 1 male (USNM); *Minnesota,* Polk County, Crookston Experiment Station, N. J. mosquito trap, 14 May 1968, leg. E. F. Cook, 1 male (UMn); Stevens County, Morris Experiment Station, N. J. mosquito trap, 21 May 1968, leg. E. F. Cook, 1 male (UMn); *Montana,* Hamilton, II-1960, C. B. Philip, dead on window sills, 5 males (JES); Ravalli Co., 12 Feb. 1941, on fresh snow, coll. W. L. Jellison, 2 males (UMn); *Nebraska,* Cedar Co., Hartington, 18 June 1969, W. W. Wirth, light trap, 1 male (USNM); *Nevada,* Reno, 23 Dec. 1915, 29 Feb. 1916, HGDyar, Coll, 2 males (USNM); [*New Mexico*], Jemez Springs, Sandoval County, N.M., I-20-IV-65, coll. G. Washburn, 1 male (JES); Las Vegas, NM, Cockerell, collector, 1 male (USNM); *Oregon,* Berry Creek, 9 mi. N. Corvallis, Benton County, R. K. Eppley, TP2:22, IV 10-23/65, *Diamesa heteropus* (Coquillett) det. R. K. Eppley 1967, 1 male (JES); Salem, Willamette R., 22 May 1963, KGoeden-light, 1 male (USNM); *Utah,* Logan, 11.8.1938, leg. D. E. Hardy, 2 males (UtStU); Logan, 11 F 09, 1 male (UtStU); Salt Lake County, Big Cottonwood Creek at the water treatment plant, leg. A. V. Nebeker, 14 March, 13 June 1965, 2 males (ANSP); Salt Lake County, Big Cottonwood Creek at the power plant below Storm Mountain, leg. A. V. Nebeker, 19 Jan. 1965, 1 male (ANSP); Wasatch Co., Heber-Midway Bridge, coll. Gerald D. Brooks, XII/17/54, *Diamesa onteona* Roback, holotype male (ANSP); *Washington,* Pullman, 15 Jan. [no year], 26 March 97, collector R. W. Doane, in ALMelander Collection, 1961, 3 males (1 determined as *Diamesa Waltlii* Meig. by Johannsen) (USNM); Pullman, 9 April 97, collector R. W. Doane, 3 males (1 determined as *Diamesa Waltlii* by ?) (USNM); Pullman [no date], in ALMelander Collection, 1961, 1 male (USNM); Pullman, WAS, 15 Apr 1919, A L Melander, in ALMelander Collection, 1961, 1 male (USNM); Pullman, 10 April 17, 12 Apr., 16.IV.30, 3 males (WashStU); Wawawai, 4/24[?] 97, collector R. W. Doane, 1 male (Cornell); Wawawai to Pullman, 2 April '50, R. Spurrier, 2 males (WashStU); WeyCo [Weyerhaeuser Lumber Company] Streams, VI-21-68, IX-7-65, 3 males (UMn); Weyhauser [*sic*] Company Experimental Station, 7-IX-65, slide No. S66-235, 236, *Diamesa heteropus* (Coq.), det J. E. Sublette '66, 2 males (JES); *Wyoming,* Albany Co., Laramie, D. W. Ribble, 25-VIII-1967, 1 male (IllNatHstSur); 44°57′42″N, 109°29′00″W, alt. 10,300′, 31 mi. N, 21 mi. W of Cody, drift in small rocky stream feeding Frozen Lake, 7 PM 13 Aug. — 9 AM 14 Aug. 1969, leg. Dean Hansen, 2 mature male pupae (UMn); Laramie, 17 Jun 1947 [41?], light trap, 1 male (UWyo); 44°17′N, 106°57′W, South Fork Campground, 12 mi. W, 5 mi. S of Buffalo, alt. 7,500′, light trap over Clear Creek, 26 Aug. 1968, leg. Dean Hansen, 1 male (UMn); 44°10′N, 107°05′W, Powder River Pass, 18 mi. W, 13 mi. S of Buffalo, alt. 9,600′, larva collected in bottom debris of tiny (2-12″ wide, to 4″ deep) stream, reared (pupa dead 1 Sept. 1967), 27 Aug. 1967, 1 male, 1 female pupae reared from larvae, apparently *heteropus* (UMn); 44°10′N, 107°05′W, Powder River Pass, 18 mi. W, 13 mi. S of Buffalo, sweeping in spruce-fir forest, 26, 27, 1967, 50 males (UMn).

Discussion. — *D. heteropus* has been described or misdetermined several times. Cockerell (1900) possibly misdetermined *heteropus* as *Eutanypus borealis* (= *D. coquilletti*). A male *heteropus* (without a determination label) labelled "Las Vegas, NM, Cockerell, Collector" was

in the material I received from the USNM. This male could be the specimen recorded by Cockerell (1900) or one of the type series of *heteropus*. Coquillett (1905) described *heteropus* from nine males and one female from Pullman, Washington; Las Vegas Hot Springs, New Mexico; and Mt. Washington, New Hampshire. There were six male *heteropus* without determination labels and a male *Diplomesa parva* (Edw.) in the material I received from the USNM. This latter specimen was labelled "Mt. Wash., Mrs. Slosson, Collector, *Diamesa waltlii* Meigen" (det. ?) and could have been the New Hampshire specimen Coquillett included in his type series. Even if not, however, I seriously doubt that Coquillett actually had *heteropus* from as far east as New Hampshire. The other specimens, although not labelled as *heteropus*, were apparently the specimens seen by Coquillett; the dates and collectors match that given by Coquillett (1905).

Garrett's (1925) *D. banana* and Roback's (1957a) *D. onteona* are synonyms of *heteropus*. I have seen the holotypes of both these species and can find no significant differences between these and *heteropus*. "*Adiamesa confusa*" Garrett (1925) is a little more of a problem. The long flagellar setae, as indicated by Garrett (1925), are reduced in number and length, but the flagellomeres, although reduced in number, are not actually shaped like those in *nivicavernicola* or *coquilletti*. The antenna is apparently simply malformed. The hypopygium of the holotype is clearly that of *heteropus*, however, so I feel the specimen is simply a *heteropus* with an aberrant, malformed antenna. Sublette (1967a) could not locate the hypopygial slide of *confusa* when he reviewed the CNC's types and therefore regarded *confusa* as a *nomen dubium*. The slide was subsequently located, however, so *confusa* is determinable and is not a *nomen dubium*, although it is a synonym.

D. heteropus is the species most commonly encountered in the West. Its range extends from Alaska to New Mexico and east to Nebraska and Minnesota. I have seen specimens collected in all months but October and November, although I presume it also emerges then.

Diamesa incallida (Walker)

Chironomus incallidus[7] Walker, 1856: 183 (described from male from England).

Ch. nexilis Walker, 1856: 184-185 (*fide* Edwards, 1929).

D. incallida (Walker). Edwards, 1929: 305-306 (description from Walker's types; synonymizes *nexilis* Walker; figures hypopygium); Goetghebuer and Lindroth, 1931: 280 (records 5 males, 1 female from Iceland); Edwards, 1932: 45 (records 2 mating pairs from Rothiemurchus Forest, G. B.); Pagast, 1947: 471

[7] From *in* (L.), not, and *callidus* (L.), expert, shrewd, crafty, cunning (Brown, 1954).

(description of adult; figure of hypopygium; records from "Estland [Estonia], Noemme" and Swedish Lappland); Wuelker, 1958: 807 (records from Germany); Wuelker, 1959: 342, 345, 346, 347 (records in Europe; comparison of pupa with that of *D. aberrata,* description of larva); Serra-Tosio, 1966: 124 (records from France); Serra-Tosio, 1969a: 205, 206 (records 2 males from Sweden, from Brundin collection); Serra-Tosio, 1971: 137-143, Figs. 48-53 (description of adult male and female, male and female pupa; distribution; ecology of larva).

D. fonticola Saether, 1969: 24-27. **New synonym.** (Described from Manitoba).

D. sp. VII. Thienemann, 1941: Tabelle 13; 41, 46, 189 (3 pupal exuviae from Swedish Lappland); Pagast, 1947: 515, 521; Abb. 75; 551, 571 (brief diagnosis of above pupal exuviae).

Psilodiamesa incallida (Walker). Roback, 1957a: 3, 5-6, 18, 20 (records from Utah).

Description (unless otherwise stated, n = 5 and measurements are in microns): as in *D. mendotae* except:

TOTAL LENGTH. — 5.2 (4.8-5.6) mm.

COLORATION. — not noted.

ANTENNA. — longest flagellar seta 0.75 (0.70-0.82)L_{fl}; Flm_{13} with apical 0.19-0.24 spindle shaped, mainly swollen ventrally; 3-5 short, slender setae dorso- and ventro-medially on Flm_1; long (MaxL 850-1055) flagellar setae 0-1 on Flm_1, 3 on Flm_2, 8-9 on Flm_3, about 9-11 on Flm_4, increasing to 14-15 on $\overline{Flm_{12}}$, numerous on Flm_{13}; setae on basal 0.1-0.3 of spindle-shaped region of Flm_{13}; $\overline{L}_{flm\,1\text{-}13}:\overline{W}_{flm\,1\text{-}13}$ 93:60, 21:52, 23:51, 25:48, 27:46, 29:46, 31:46, 34:45, 38:44, 40:44, 44:42, 46:42, 724:40; AR 1.44 (1.24-1.72); 1 preapical antennal seta; L_{pas} 47 (36-55); D_{pd} 184 (173-198); 1-3 pedicellar setae ventro-medially; H_{sc} 198 (186-212).

HEAD. — W_h 737 (703-799); epistomal suture strong to moderate medially, weak to absent laterally; IOS/side 3 (2-5) (not separable from inner verticals in 1 specimen); PtOS 11-18/side; inner verticals reaching to 0.58 (0.45-0.63) of distance from dorso-medial margin of eye to midline of vertex. Clypeus slightly swollen anteriorly, about as wide as long; CS 10 (5-14). Eyes not hairy, microtrichia visible antero-medially as minute points, not visible laterally; dorso-medial margin truncate but very slightly rounded, dorsal corner broadly rounded; H_e 311 (307-317). $\overline{L}_{ps\,2\text{-}5}:\overline{W}_{ps\,2\text{-}5}:\overline{MaxL}_{pss\,2\text{-}5}$ 102:48:113, 172:53:124, 166:41:122, 230:35:43; CP 1.11 (1.03-1.21); palpal stoutness 3.78 (3.46-4.27).

THORAX. — L_{th} 1.50 (1.34-1.65) mm, D_{th} 1.43 (1.31-1.60) mm. Antepronotum with medial commissure strong, not quite reaching to rear margin of phragma I, not surpassing scutal process; antepronotal notch slightly acute to right-angled, with medial corners rounded and well surpassing scutal process; LAS/side 12 (8-14); postpronotum without setae but with 0-2 faint sensilla (?) on antero-dorsal border. Dorsocentrals uniserial to slightly staggered posteriorly; DCS/side 11 (8-14), $MaxL_{dcs}$ 162 (139-188); PAS/side 11 (6-14); ScS 23 (19-29), $MaxL_{scs}$ 191 (150-220); ASR 0.62 (0.60-0.66); 0-6 setae on epimeral II protuberance.

WING. — L_w 3.6 (3.4-3.9) mm, W_w 1.13 (1.00-1.21) mm. Dry wing not available. Slide mounted wing showing: costal projection 137 (119-178) or 7.2 (6.0-9.0) times its width; apparent m-cu distal to apparent fCu by about 2.4 times width of

apparent m-cu; VR 0.93 (0.90-0.95); M_{3+4} weak. Remigium with 1 strong seta on hand, 0-1 weak seta and about 10-13 campaniform sensilla just beyond wrist, and 1-3 setae and 4 large and about 8 smaller campaniform sensilla on distal 0.5 of forearm. Setae 13 (8-16) on R, 9 (5-10) on R_1, and 5 (3-8) on R_{4+5} (uinserial and dorsal on all). Campaniform sensilla 3 ventrally on Sc just beyond arculus, 2 dorsally on R_1, 1 dorsally and 0 ventrally near base of R_{2+3}, and 2-4 dorsally on R_{4+5}. Squama with 25-43 strong setae, $MaxL_{sqs}$ 150-180 (n = 3).

Legs. — $\bar{L}_{p_I}:\bar{L}_{tot}$ 1.05; Fe I apparently without postero-dorsal beard. Apical spur of Ti I long, slender, with sparse prickles on basal 0.2-0.3; apical spurs otherwise essentially as in *D. mendotae.* Polygon pattern on Ti III well developed. Ti III with posterior comb of about 13-23 spines arranged in a fairly regular row. Spiniform setae on first 3 tarsomeres of P I-III as follows: 2 (apical), 2 (apical), 0: 9-15, 2 (apical)-5, 0; 13-18, 6-9, 0-1 (at about 0.7). Lengths and ratios of leg segments as follows:

	Fe	Ti	Tm_1	Tm_{2-5}	LR	BV	SV
P_I	1460 (1310–1690)	1670 (1290–1960)	1140 (870–1330)	1180 (1010–1290)	0.68 (0.68–0.70)	3.62 (3.45–3.85)	2.76 (2.59–2.98)
P_{II}	1650 (1430–1930)	1590 (1330–1890)	800 (670–940)	960 (860–1040)	0.50 (0.47–0.52)	4.20 (4.00–4.57)	4.07 (3.87–4.32)
P_{III}	1880 (1650–2160)	1940 (1600–2300)	1320 (1040–1600)	1310 (1180–1410)	0.68 (0.65–0.69)	3.91 (3.64–4.29)	2.91 (2.79–3.11)

Hypopygium (without reference to *D. mendotae*). — Fig. 110. Tg IX with 22 (15-27) setae/side. Anal point absent; Tg IX very weak medially, appearing to be formed of two separate sclerites; L_{gncx} 350 (304-388); $\bar{L}_{tot}:\bar{L}_{gncx}$ 14. Basal plate weakly developed, with microtrichia ventrally, margin usually nearly straight disto-medially. Medial field well developed, with sharply delimited dorsal border and with numerous microtrichia and setae; distal end of medial field not or only just slightly free. Gonostylus fairly broad, roughly of equal width throughout, with single subterminal peg and moderate terminal ridge. Sternapodeme somewhat broadened medially, fore margin convex, straight, or slightly concave medially. Basal wedge short but well-developed, rugose laterally.

Diagnosis. — Antenna plumose, eyes not hairy; anal point absent; medial field well delimited dorsally. *D. aberrata* is similar but has an anal point and a more slender gonostylus.

Material examined. — *Alaska,* Anchorage, 24 Sept. 1964, K. Sommerman, jeep trap, 2 males (USNM); Anchorage-Seward Hwy. 25 Aug. 1964, K. Sommerman, jeep trap, 1 male (USNM); [*Austria*], TIROL, Igls, 2000 m., 25. VI. 1953, J. R. Vockeroth, 1 male (CNC); Obergurgl, TIROL, 1950 m., 16-VIII-1953, J. R. Vockeroth, 1 male (CNC); [*France*], massif du Taillefer, Alpes françaises, 15.6.67, 1 male, 2 pupal exuviae (UMn); *Manitoba,* The Bog near The Pas, 5.VII.1967, leg.

A. L. Hamilton and O. A. Saether, 1 male reared from pupa, 1 female (types of *D. fonticola*) (CNC); *Ontario,* Ottawa, Arboretum, C. E. F., 24-V-67, Jon Martin, 0.56.7, 1 male (JES); *Utah,* Salt Lake County, Big Cottonwood Creek at the water treatment plant, leg. A. V. Nebeker, 7 Nov. 1964, 3 males (ANSP); Summit Co., Stewart's Ranch, North Fork of Provo River, Coll. Gerald D. Brooks, II/20/54, 1 badly battered male without hypopygium (ANSP); *Washington,* Weyerhauser Company Expt. Station, 7-IX-65, slide No. S66-237, 1 male (JES); *Wyoming,* 41°20′N, 106°10′W, 3 mi NNW of Centennial, sweeping by Nash Fork of Little Laramie River, 23 March, 1968, leg. Dean Hansen, 2 males (UMn); as above, but found in (or in drift from) shallow (1-2″ deep) spring area at edge of river, 3 males reared from pupae (UMn); as above, but 24 March 1968, on rocks at splash line in small beaver pond by river, numerous pupal exuviae (UMn); 44°10′N, 107°05′W, Powder River Pass, 18 mi W, 13 mi S of Buffalo, alt 9,600′, sweeping in spruce-fir forest, 26, 27 Aug. 1967, 27 Aug. 1968, leg. D. Hansen, 9 males (UnM); [*Yukon Territories*], Whitehorse, Y. T., 12.VII.1949, L. R. Pickering, 1 male (CNC).

Discussion. — Walker (1856) described *Ch. incallidus* and *nexilis* from a single male each. The species remained unrecognizable for 73 years until Edwards (1929) examined Walker's material and figured the hypopygium of *incallida.* Edwards (1929) also synonymized *nexilis* with *incallida.* I have seen neither of Walker's types, but I am accepting Edwards' synonymy.

D. incallida has been recorded from several localities in Europe, and Roback (1957a) recorded it from Utah. Saether (1969) described *D. fonticola* from Manitoba and stated that Roback's record of *incallida* was incorrect. Saether (1969) states that his *fonticola* differs from *incallida* "in the placement of hairs on tergite IX and probably in the shape of the dististyle." At that time, as noted by Saether, *incallida* had not been adequately described. Serra-Tosio (1971), however, subsequently described *incallida* quite well, both in the adult and pupal stages, and he also sent me some specimens of *incallida* for examination. My specimens of *incallida* differ from european ones only in a few details. The range in AR runs higher and the lengths of the leg segments and the BV's are larger, but in nearly all other aspects the european and nearctic specimens are very similar. Saether (1969) states that the pupa of *fonticola* differs from that of *incallida* in lacking well-developed thorns on tergite II. Serra-Tosio (1971: 140, Pl. 52), however, shows only very small dorsal thorns on tergite II in european *incallida,* so the pupae, too, of *fonticola* and *incallida* are not distinctly separable. I am therefore synonymizing *fonticola* with *incallida.*

The specimen recorded by Roback (1957a) was in material borrowed from the ANSP. Unfortunately, however, the hypopygium was not with the specimen, so I must base a determination mainly on Roback's hypo-

pygial figure. It seems fairly safe to say, however, that Roback's specimen was actually *incallida.*

Location of type. — Holotype of *incallida* at the BM(NH) (Edwards, 1929).

Diamesa insignipes Kieffer

D. insignipes Kieffer, *in* Kieffer and Thienemann, 1908: 3 (described from female from Insel Ruegen, [now East] Germany); Thienemann, *in* Kieffer and Thienemann, 1908: 126-127 (description of pupa and pupal exuviae from Insel Ruegen); Thienemann, *in* Kieffer and Thienemann, 1908: 283 (records above specimens as cold water inhabitants of brooks, channels ("Rinnsalen"), and springs from the Halbinsel Jasmund from Ruegen); Thienemann, 1912a: 73 (cites above record); Thienemann, 1912b: 70 (cited in Thienemann, 1934: 7; not seen by author); Potthast, 1915: 355-356 (brief description of pupa); Thienemann, 1919a: 122 (pupa in key); Thienemann, 1926: 323 (in part) (cites records from Kieffer and Thienemann, 1908: 126-127; cites record from Kieffer, 1924: 54-55, which is probably not *insignipes*); Pagast, 1947: 478-479, 528-529, 574 (description of adult male and pupa; distribution from Germany; specimens seen included original material seen by Thienemann); Thienemann, 1950a: 146 (records (?) from "Ybbs, Ois"); Thienemann, 1952: 254 (larva in key; brief description); Thienemann, 1954: 177, 344, 347, 348, 354, 360, 364 (ecology, distribution of larva); Dittmar, 1955: 471, 475, 479, 480, 481 (records larvae, adults from Germany); Wuelker, 1959: 348-349 (briefly discusses identity of larva; records from Falkau, Germany, and northern Spain); Serra-Tosio, 1964: 44 (records numerous "stades preimaginaux" and 1 adult male from Mirable (Ardeche), France); Berczik, 1968a: 18, 19 (records from Hungary; figure of portions of pupa); Berczik, 1968b: 17 (records larvae, pupae from Hungary; description, figures of larva and pupa); Serra-Tosio, 1971: 214-220, Figs. 92, 93, 161 (description of adult male, male and female pupa; distribution; ecology).

D. prolongata Kieffer, 1909: 40-41 (described from male from Westphalia, Germany); Kieffer and Thienemann, 1909: 33 (records larvae on stones in a springbrook ("Quellbach") in Westphalia); Kieffer, 1911b: 19 (brief description of female); Thienemann, 1912a: 55, 73 (records mermithid parasitizing larva; records many larvae and pupal exuviae from algal pads on stones in strong current, adults reared in May, from the Sauerland, Germany); Thienemann, 1912b: 25, 37 (cited by Thienemann, 1934: 7; not seen by author); Potthast, 1915: 356-357 (description of larva and pupa); Thienemann, 1919a: 121, 122 (larva and pupa in key; states larva and pupa are indistinguishable from "*Psilodiamesa*" *spitzbergensis* Kieffer); Thienemann, 1919b: 32 (cited by Thienemann, 1934: 7; not seen by author); Edwards, 1929: 305 (brief description of male; figure of hypopygium; records from various localities in Gt. Britain); Goetghebuer, 1932: 183, 185, Fig. 313 (brief description of male; larva and pupa in key; records from Black Forest and Todtmoos, Germany); Goetghebuer, 1934: 88 (in list of species collected by Thienemann in Garmish-Partenkirchen); Thienemann, 1934: 7 (review of literature citations); Goetghebuer and Lenz, 1939: 14, Fig. 21 (brief description; figure of hypopygium).

D. sp. *insignipes-prolongata* Gr. Nietzke, 1937: 47, 70; tables facing 24, 58 (records from the Kossau, a stream in Germany).

[*non*] *D. insignipes* Kieffer, 1924: 54-55 (misdetermination of some *Diamesa* species); Goetghebuer, 1932: 183-184 (as above); Goetghebuer and Lenz, 1939: 13-14 (as above).

Brachydiamesa steinboeckii Goetg. Berg, 1948: 183 (misdetermination; records larvae from the muddy bottom of the River Susaa).

Description (unless otherwise stated, n = 3 and measurements are in microns): as in *D. mendotae* except:

TOTAL LENGTH. — 5.4 (5.1-5.7) mm.

COLORATION. — not noted.

ANTENNA (n = 1). — longest flagellar seta $0.60L_{fl}$; Flm_{13} with apical 0.27 spindle-shaped, mainly swollen ventrally; 2 short, slender setae dorso- and ventromedially on Flm_1; long (MaxL 736) flagellar setae 1 on Flm_1, 3 on Flm_2, 9 on Flm_3, about 10 on Flm_4, increasing to 15 on Flm_{12}, numerous on Flm_{13}; setae only on basal 0.1 of spindle-shaped region of Flm_{13} except for 1 strong, isolated seta at 0.5 of spindle-shaped region which reaches apex of Flm_{13}; $\bar{L}_{\underset{1-13}{flm}}:\bar{W}_{\underset{1-13}{flm}}$ 98:63, 24:54, 27:51, 32:46, 32:44, 32:44, 34:41, 37:44, 39:41, 44:41, 46:41, 44:41, 686:39; AR 1.26; 1 preapical antennal seta; L_{pas} 51; D_{pd} 181, 185 (n = 2); 1 pedicellar seta ventro-medially; H_{sc} 194 (189-199) (n = 3).

HEAD. — W_h 700 (676-727); dorsal ocular apodeme strong, long; epistomal suture moderate to weak medially, moderate to absent laterally; IOS/side 6 (5-7); PtOS/side 12-16; inner verticals reaching to 0.62 (0.54-0.67) of distance from dorsomedial margin of eye to midline of vertex. CS 11 (8-13). Dorso-medial margin of eye extending not quite as far mesad as ventro-medial margin; H_e 312 (307-322). $\bar{L}_{\underset{2-5}{ps}}:\bar{W}_{\underset{2-5}{ps}}:\overline{MaxL}_{\underset{2-5}{pss}}$ 125:55:128, 174:58:97, 165:46:82, 226:36:37; D_{so} 19 (18-20); CP 1.02 (1.00-1.05); palpal stoutness 3.53 (3.45-3.59).

THORAX. — L_{th} 1.30 (1.26-1.34), D_{th} 1.33 (1.26-1.39) mm. Antepronotum with medial commissure strong, not quite reaching rear margin of phragma I, not surpassing anterior margin of scutal process; antepronotal notch slightly obtuse, with medial corners rounded and only moderately surpassing scutal process. LAS/side about 14 (n = 1). Dorsocentrals uniserial to slightly staggered posteriorly; DCS/side 13 (11-15) (n = 3), $MaxL_{dcs}$ 208 (n = 1); PAS/side 8 (5-11); ScS about 30, length not measurable on slides available. ASR 0.62 (0.61-0.64); 1-4 setae on epimeral II protuberance.

WING. — L_w 3.4-3.7 mm, W_w 1.12-1.19 mm. Dry wing not available. Slide mounted wing showing: costal projection 79-101 or 4.0-4.6 times its width; apparent m-cu distal to apparent fCu by about 1-4 times width of apparent m-cu; VR 0.90-0.95. Remigium with 1-2 fairly strong setae on hand, 0-1 weak seta and about 14 campaniform sensilla just beyond wrist, and 3 setae and 4 large and about 9 smaller campaniform sensilla on distal 0.5 of forearm. Setae 10-16 on R, 8-9 on R_1, and 9-14 on R_{4+5} (uniserial and dorsal on all). Campaniform sensilla 2-3 ventrally on Sc just beyond arculus, 2-5 dorsally on R_1, 0-1 dorsally and 1 ventrally near base of R_{2+3}, and 3-4 dorsally on R_{4+5}. Squama with about 36-56 strong setae, $MaxL_{sqs}$ 188-202.

LEGS. — $\bar{L}_{\underset{I}{p}}:\bar{L}_{tot}$ 0.91; Fe I with moderate postero-dorsal beard of about 15-20

long setae. Apical spur of Ti I long, slender, with fairly numerous prickles on basal 0.3; L_{tispI} 64-74; apical spurs of Ti II stouter, particularly basally, subequal to equal in length, with numerous prickles on basal 0.4-0.5; L_{tispII} 48-55; apical spurs of Ti III with numerous prickles on basal 0.4-0.5; $L_{atispIII}$ 45-50, $L_{ptispIII}$ 76-86. Weak polygon pattern not visible near apex of Ti I; polygon pattern on Ti III very faint. Spiniform setae on first 3 tarsomeres of P I-III as follows: 4-10, 2 (apical)-7, 0; 9-13, 6-7, 0-3; 13-20, 6-9, 0-2 (at about 0.7). Lengths and ratios of leg segments as follows:

	Fe	Ti	Tm_1	Tm_{2-5}	LR	BV	SV
P_I	1530 (1450–1600)	1720 (1650–1760)	1110 (1050–1140)	1230 (1160–1300)	0.64–0.65	3.53 (3.47–3.58)	2.93 (2.90–2.95)
P_{II}	1670 (1720–1610)	1540 (1460–1630)	730 (690–770)	990 (910–1040)	0.47	4.00 (3.90–4.15)	4.49 (4.44–4.58)
P_{III}	1880 (1760–1960)	1820 (1760–1930)	1170 (1110–1210)	1280 (1190–1290)	0.64 (0.62–0.68)	3.82 (3.78–3.88)	3.16 (3.06–3.26)

Hypopygium (without reference to *D. mendotae*). — Fig. 138. Tg IX with 10-18 setae/side. Anal point strong, long, gradually broadening basally, apparently without or with only minute apical peg; strong apodemes on underside of Tg IX running first more or less parallel, then diverging and arching to antero-lateral corners of Tg IX; L_{gncx} 426-449; L_{tot}:L_{gncx} 12. Gonocoxite very long. Basal plate weak, without microtrichia ventrally; medial field well developed, without microtrichia, with 2-4 very long, strong setae at about 0.4 its length and 2-4 long, strong setae at distal end; distal 0.7 of medial field free. Gonostylus very long, quite broad, distal 0.2 slightly expanded; gonostylus with small subterminal peg, without terminal ridge. Sternapodeme very broad medially, with weak antero-lateral projections; fore margin nearly straight to slightly concave medially. Basal wedge strong, long, rugose laterally.

Diagnosis. — The long gonocoxite and gonostylus and slender, distally-free medial field are close to no other species.

Material examined. — *Wyoming*, Teton County, Snake River at Highway 22 west of Jackson, 6 March 1965, leg. A. V. Nebeker, 5 males (ANSP).

Discussion. — *D. insignipes* has had quite a workout in the European literature. It was originally described from an adult female from northern Germany. Pagast (1947) figured the male hypopygium and synonymized *D. prolongata* Kieffer with *insignipes*. Both Pagast (1947: Abb. 40) and Serra-Tosio (1971: Pl. 92, Fig. 1) show a slight mound or protuberance on the medial side of the gonostylus at about half its length; this mound is nearly absent in my specimens. Serra-Tosio (1971: 215-216) described a European specimen of *insignipes;* it had slightly fewer interocular setae

(3, not 5-7) and slightly fewer dorsocentral setae (9, not 11-15) but it otherwise generally falls within the range of intraspecific variation I found in the 3 specimens I measured from Wyoming. Until I can see more specimens of all three stages showing clear differences with European populations, I shall regard the nearctic specimens as being conspecific with the European *insignipes.*

Location of type. — Pagast (1947: 574) examined pupal exuviae seen by Thienemann (in Kieffer and Thienemann, 1908). These apparently were destroyed in World War II (Thienemann, 1950c). I do not know the whereabouts of the female type described by Kieffer.

Diamesa leona Roback

D. leona Roback, 1957a: 7-8, 21 (described from 12 males from Utah; figures hypopygium, wing, antenna, palpus, tibial comb and spurs); Roback, 1959: 2 (records from Montana, notes mistake in leg and antennal ratios in original description).

D. pieta Roback, 1957a: 8-9 (described from 4 males, 1 female, from Utah). **New synonym.**

D. caena Roback, 1957a: 9 (described from 1 male, 1 female, from Utah). **New synonym.**

Description of macropterous form (unless otherwise stated, n = 5 and measurements are in microns): as in *D. amplexivirilia* except:

Total length. — 4.6 (3.9-5.3) mm (n = 8).

Coloration. — not noted.

Antenna. — Similar to Fig. 43. 8 flagellomeres, rarely with partial fusion of $Flm_{1\,\&\,2}$ or $Flm_{4\,\&\,5}$; non-plumose, longest flagellar seta (on Flm_8) 0.18 (0.16-0.19) L_{fl}; Flm_8 roughly cylindrical in basal 0.6-0.8, tapering beyond to blunt apex; flagellar setae short (MaxL 75-111), setae 3-6 on $Flm_{1\,\&\,2}$, 3-5 on Flm_3, 0-1 on Flm_4, 0-3 on Flm_5, 0-1 on Flm_6, 0-2 on Flm_7, 4-6 on Flm_8. Antennal sensilla as follows (n = 2): large, blunt sensillum basiconicum 1 on $Flm_{1\text{-}5}$; slightly smaller, blunt sensilla basiconica 1-3 on $Flm_{1\,\&\,2}$, 1-2 on Flm_3, 1 on Flm_4, 2 on Flm_5, 3-5 on Flm_6, 6-8 on Flm_7, apparently 1 on Flm_8 (the latter longer, more pointed, but arising from a distinct pit); long, pointed sensilla basiconica 6-11 on Flm_6, about 12-about 14 on Flm_7, numerous on Flm_8; ringed sensilla coeloconica 3 dorsal, 2-3 ventral on Flm_1, 1-2 dorsal, 1 ventral on Flm_2, 9-19(!) on Flm_8; small sensilla coeloconica 2-3 on Flm_1, 1 on $Flm_{2\,\&\,3}$, 3-5 near apex of Flm_8. $\overline{L}_{flm\,1\text{-}8}:\overline{W}_{flm\,1\text{-}8}$ 101:41, 45:39, 38:36. 27:32, 28:36, 28:34, 34:38, 202:44; AR 0.64 (0.53-0-72); L_{pas} 28 (22-34); D_{pd} 82 (79-85); pedicellar setae absent; H_{sc} 83 (69-105); scape slightly weaker dorsally.

Head. — Simliar to head of brachypterous form, Fig. 55. W_h 594 (564-622); coronal suture moderate to weak, usually ending between tops of antennal sockets and lower ends of vertex projections over scapes, but occasionally weakly or interruptedly extending to between scapes, bifurcating very far back on dorsal region of vertex, with moderate to weak coronal apodeme; coronal triangle very small or apparently absent, not or only barely visible anteriorly; rear margin of vertex produced dorsad at midline to form small, clear, triangular or nearly rectangular nape; reduced ocelli fairly far apart, on or just above vertex projections over scapes, at or usually

well below level of tops of antennal sockets; dorsal ocular apodeme absent or weak and nearly vertical; epistomal suture weak but usually reaching ATP's, often interrupted laterally; interocular setae easily distinguishable from inner verticals, in fairly well defined group centered 0.4-0.6 of distance from dorso-medial margin of eye to midline of vertex; IOS/side 6.5 (5-9); postocular setae in uniserial row running just behind rear margin of eye from near postero-ventral eye margin, row ending well or slightly below 3-5 longer, stronger outer vertical setae; PtOS/side 7-12; inner verticals fairly easily distinguishable from outer verticals, inner verticals shorter, more curved, and more decumbent, dispersed on vertex just dorsad and dorso-mesad to dorso-medial corner of eye; inner verticals not or only slightly occurring below dorsal margin of eye anteriorly, reaching to 0.44 (0.42-0.47) of the distance from dorso-medial margin of eye to midline of vertex; 2 medial vertex setae rarely present. CS 11 (5-15). Tentorium usually extending slightly or moderately beyond PTP. H_e 286 (262-311); ventral ocular apodeme very short and weak or absent. PS_1 with 0-4 setae, subglobose, nearly or as well sclerotized as other palpal segments (Fig. 57); $\overline{L}_{ps_{2\text{-}5}}:\overline{W}_{ps_{2\text{-}5}}:\overline{MaxL}_{pss_{2\text{-}5}}$ 71:57:47, 126:60:40, 108:50:33, 145:37:22; sunken organ more or less hemispherical, very prominent, at about 0.7 of PS_3; D_{so} 26 (20-32); CP 1.34 (1.17-1.52); palpal stoutness 2.19 (1.91-2.54). Cibarial pump wider than high, sides straight or slightly concave, cornua fairly long, slender, slightly arched (Fig. 59).

THORAX. — Figs. 75, 87. L_{th} 1.33 (0.97-1.53) mm (n = 8), D_{th} 1.16 (0.87-1.34) mm (n = 8). Antepronotum with medial commissure absent or very weak, if present extending anteriorly from fore margin of scutum; antepronotal notch varying from completely absent to acute to right-angled; medial corners varying from absent (i.e., fore margins of antepronotal halves are continuous medially) to fairly broadly rounded and well surpassing scutum; anterior margins of antepronotal halves fairly straight medially, arching back and then becoming concave antero-laterally; lateral antepronotal setae dispersed on prominently swollen lateral region; LAS/side 17 (11-about 23). Scutum in side view moderately flattened, not or only very slightly indented approximately above parapsidal suture, not extending beyond fore margin of antepronotum; scutal process weak, quite wide. Dorsocentral setae uniserial to staggered at anterior or posterior end of rows; DCS/side 10 (8-14), $MaxL_{dcs}$ about 115 (about 110-133); 1 acrostichal seta occasionally present. PAS/side 6 (5-9); scutal angle strong, rounded; parapsidal suture only weakly arched, with internal apodeme; humeral scar a tuberose area distinctly anterior to dorsal 0.3 of parapsidal suture; medial scutal scar running as a faint band from just behind scutal process to about midpoint of scutum, there expanding to form broader, pale scar which narrows and disappears at about ends of dorsocentral setae rows. Scutellar setae roughly in 2 rows; ScS 28 (22-34), $MaxL_{scs}$ 105-127 (n = 4). Medial cleft of postnotum not reaching weak postero-dorsal corner; postnotum with suture on midline postero-ventrally. Anteanepisternal pit small and weakly defined or absent; medio-anepisternum II occasionally not well delimited ventrally, usually somewhat sharply rounded ventrally; anapleural suture slightly weakened; ASR 0.56 (0.55-0.58); 0-2 setae on epimeral II protuberance, which is moderately developed; no other setae on epimeron II; 0-7 short setae on preepisternum II just below anapleural suture.

WING. — L_w 3.2 (2.9-3.6) mm, W_w 1.2 (1.1-1.2) mm. Outline as in Fig. 99. Wing margin usually slightly concave about at end of R_1, M_{3+4}, and Cu_1, slightly

concave distal to anal lobe; anal lobe slightly obtuse to about right-angled; microtrichia visible as numerous, close points at 150×, seta-like projections just discernible at 650×; costal projection 85 (66-105) or 2.9 (2.5-3.3) times its width; Sc appearing as a sharp fold proximally, becoming very weak just distal to forking of R, ending before C. r-m strong, quite strongly arched, particularly proximally; vestige of ?R_5 appearing as faint, ill-defined band just anterior to distal 0.3 of M_{1+2}; vestige of ?M_2 appearing as faint, ill-defined band just posterior to distal 0.6-0.8 of M_{1+2}; apparent m-cu ranging from directly over apparent fCu to distal to apparent fCu by width of apparent m-cu; VR 0.99 (0.95-1.02). Remigium with 1 strong or 1 strong and 1 weaker seta on hand, 0-1 weak seta and about 8-15 campaniform sensilla just beyond wrist, and 1-3 setae and 3-4 large and about 8-10 smaller campaniform sensilla on distal 0.5 of forearm. Setae 11 (7-17) on R, 11 (7-15) on R_1, and 8 (3-12) on R_{4+5} (uniserial and dorsal on all). Campaniform sensilla 3-4 ventrally on Sc just beyond arculus, 1-2 dorsally on R_1, 1 dorsally and 1 ventrally near base of R_{2+3}, and 0 on R_{4+5}. Squama with 20-37 setae, $MaxL_{sqs}$ 73-110.

LEGS. — Legs very long, somewhat thicker than other species; $\overline{L}_{p_I}:\overline{L}_{tot}$ 1.55. Apical spur of Ti I short, basal 0.5 expanded, with numerous prickles on basal 0.7 (Fig. 106); L_{tispI} 45-52; apical spurs of Ti II stouter, basal 0.8 enlarged and covered with numerous fine prickles, distal 0.2 bare, tapering to a sharp point (Fig. 107); L_{tispII} 52-62; apical spurs of Ti III with fairly numerous prickles on moderately expanded basal 0.5-0.6, distal 0.5-0.4 tapering to a sharp point; $L_{atispIII}$ 55-62, $L_{ptispIII}$ 71-90; all apical tibial spurs with oval mark (sensory dome?) on basal 0.3-0.6. Ti III with posterior comb of 15-27 spines arranged in a fairly regular single row. Spiniform setae on first 3 tarsomeres of P I-III as follows: 2 (apical), 2 (apical), 2 (apical); 7-20, 2 (apical)-7, 2 (apical)-4; 11-27, 7-11, 1 (at about 0.4)-6. Tm_4 with cordiform condition much reduced; membranous, ventral sole not extending beyond latero-distal margin of Tm_4; articulation of Tm_5 distinctly proximal to apical margin of Tm_4, but dorso-lateral region of Tm_4 not at all constricted just before apex. Claws tapering slightly distally, with about 5 apical teeth (western specimens) or a pointed apex without teeth (Minnesota and New Brunswick specimens). Lengths and ratios of leg segments as follows:

I. Western specimens (n = 3):

	Fe	Ti	Tm_1	Tm_{2-5}	LR	BV	SV
P_I	1720–1830	1600–1630	820–860	890	0.51–0.53	4.65–4.77	3.95–4.16
P_{II}	1860–1990	1430–1500	540–570	720–740	0.36–0.40	5.39–5.44	5.82–6.45
P_{III}	1960–2160	1690–1720	890–910	960–1010	0.52–0.53	4.62–4.82	4.10–4.37

II. Minnesota and New Brunswick specimens (n = 2):

	Fe	Ti	Tm_1	$Tm_{2\text{-}5}$	LR	BV	SV
P_I	2270, 2300	2200, 2300	1310, 1340	1230, 1240	0.58, 0.60	4.73, 4.75	3.40, 3.43
P_{II}	2300, 2400	1930, 2030	920	970	0.46, 0.48	5.29, 5.49	4.57, 4.79
P_{III}	2430 2470	2370	1360 1390	1380, 1430	0.58, 0.59	4.31, 4.52	3.47, 3.53

Hypopygium (without reference to *D. amplexivirilia*). — Figs. 116, 117. Tg IX with about 8 to about 20 very short, fine setae/side. Anal point short, weakly sclerotized, directed ventrad, often not visible in slide mounts; apodemes not present on underside of Tg IX. L_{gncx} 566 (487-608); $\bar{L}_{tot}$:$\bar{L}_{gncx}$ 8. Gonocoxite long, broad, with numerous short, anteriorly-directed setae; gonocoxite with slight broad ridge antero-dorsally. Basal plate weakly developed, slightly notched disto-medially. Medial field not or only very weakly developed, with no definite dorsal border. Gonostylus strong, with numerous short, proximally-directed setae; medial surface of gonostylus with fine "pile" of microtrichia. Sternapodeme very strong, produced to a point anteromedially. Basal wedge fairly short, small.

Diagnosis. — Short, near-vertical anal point; gonocoxites with short, anteriorly directed setae, gonostylus with "pile" on medial surface. Easily told from *D. leoniella* by its larger size and the structure of the anal point.

Material examined. — *Colorado,* 38°35'N, 106°04'W, 3.2 mi. S junction US 285 and Colo 291, 6 mi. NW Salida, on rocks at splashline, Arkansas River, 11 Dec. 1968, leg. D. Hansen, 5 macropterous males, about 15 macropterous females, about 10 brachypterous males, 7 male pupal exuviae (UMn); *Idaho,* Lemhi Co., Salmon River, Hwy. 93, 20 miles south of Salmon, 7 March 1965, leg. A. V. Nebeker, 2 males (ANSP); Lemhi County, Texas Creek, Hwy 28, 2 mi. south of Leadore, 7 March 1965, leg. A. V. Nebeker, 3 males (ANSP); Fremont-Teton Co. border, N. Fork Teton River at Hwy 32, 6 March 1965, leg. A. V. Nebeker, 5 males (ANSP); *Minnesota,* Cook Co., 2 miles N of Hovland on US 61, 2 June 1970, N. J. mosquito trap, leg. E. F. Cook, 1 male (UMn); *Montana,* Clark Fork River, Deep Creek, II/18/58, leg. Spindler, 3 battered males (ANSP); Clark Fork River, Sawmill Gulch, leg. Spindler, II/19/58, 14 males, 3 females (ANSP); W. Gallatin R., Gallatin Co., I-18-1948, R. Hays, 19 males, 1 female (USNM); *Nevada,* Reno, 6 Jan 1923, H. S. Barber, 3 males (USNM); [*New Brunswick*], Camp Adams, Northumb. Co., N. B., 5.VI.1962, J. Marshall, 2 males (CNC); [*New Mexico*], Taos Co. N. M., Rio Grande R. nr. San Cristobel, 14 Mar. 1954, J. M. Campbell, lot 59-1760-21, 1 male (USNM); *Quebec,* Hull, 7.V.1924, C. H. Curran, 2 males (CNC); *Utah,* Salt Lake County, various localities along Big Cottonwood Creek, Nov., Dec., 1964, Feb., March, June 1965, 7 macropterous, 4 brachypterous males, 10 females, leg. A. V. Nebeker (ANSP); Utah County, Diamond Creek at Hwy. 50-89, 31 Jan. 1965, leg. A. V. Nebeker, 4 males (UMn); Wasatch Co., Heber-Midway Bridge, II/13/54, coll. Gerald D. Brooks, 2 paratype males (1 lacks genitalia) (USNM), holotype male

(ANSP), holotype male of *D. pieta* Roback (ANSP), holotype male of *D. caena* Roback (ANSP), 2 males determined as *D. pieta* but not designated as paratypes (ANSP), 4 paratype males (ANSP); [*Washington*], Columbia R., 17.IV.1952, 10.IV. 1962, 22 pupal exuviae, 5 males (CNC); Columbia R., Hampton Brantford C., 6.III. 1952, 7.II.1962, 20 males, 8 females, 13 pupal exuviae (CNC).

Discussion. — Roback (1957a) described *D. leona, pieta,* and *caena* from about 20 specimens collected at the same site on two different dates. Roback separates the three species on variations in color and on the presence or absence of an anal point. Dr. Roback kindly loaned me the type material of all three of his species, and, after examining them, I concluded that they are all one species.

D. leona was described as being macropterous and having a short, postero-ventrally directed anal point (Roback, 1957a: 7-8, Figs. 20, 27). I examined the holotype (alcohol specimen, hypopygium not removed) and found the hypopygium essentially as in Fig. 116, although the anal point seems a little weaker than that illustrated in Fig. 117. Roback separated *pieta* from *leona* mainly on details of body coloration. An examination of the holotype of *pieta* (alcohol specimen, hypopygium not removed) shows that, while the coloration differences noted by Roback do exist, the holotype of *pieta* is simply a somewhat teneral specimen of *leona.* The legs, particularly the femora, are still slightly arched and have not completely sclerotized. The legs are still pale, and the hypopygium is brown only antero-laterally and medially. This coloration, however, is simply due to the specimen being teneral, and is certainly not a specific difference. I feel I am quite justified, therefore, to synonymize *pieta* with *leona.* Roback (1957a) separated *caena* from *leona* on the basis of the brachyptery and the absence of an anal point. The proctiger in the holotype of *caena* (again, an alcohol specimen, hypopygium not removed) is inverted into the abdomen, and the posterior margin of the ninth tergite is folded down and slightly forward, and, indeed, the anal point seems, at first glance, to be absent. A little teasing with a needle, however, clearly shows that *caena* has a weak anal point quite like that in *leona* and *pieta.* The wings are strikingly reduced and extend only as far as the end of the second abdominal tergite. This reduction, however, is simply the extreme in wing reduction; specimens I collected at the same site and at the same time in Colorado show intermediate stages between being fully macropterous and quite brachypterous (Figs. 99-101). Serra-Tosio (1971: 190, pl. 73) observed the same condition in the closely-related european *D. steinboecki* Goet. It seems to me, therefore, that *caena* is simply a brachypterous form of *leona,* and I am therefore synonymizing *caena* with *leona.*

The holotype of *caena* shows the same morphological changes in the thorax I illustrated from the other brachypterous specimens, i.e., the antepronotal sclerites broadly fuse medially (as in Fig. 88), preepisternum II is compressed (as in Fig. 76), and the anapleural suture is shortened (as in Fig. 76).

I have collected *leona* only once; this was in December in a fair-sized river (Fig. 34, 35). Emergence dates for specimens examined are from November to June.

A few macropterous specimens from Nevada deserve special comment. Folded and pinned with one of the specimens was a small hand-written note which read: "[R. C.] Shannon! - - - what are these fool flies? They run clumsily on rocks around which the river bubbles, but when they get to the surface of the water they dart skimming here and there, like Gyrinidae, except using their wings while their feet appear to trail the water surface. ♂ & ♀ same habits, skimming over rough swift water, - - - catchable only when running on stones. . . . Have never before seen this supposed Chironomid nor anything with similar life forms - - - Reno, Jan. 6, 1923, H. S. B[arber]." I have seen some female orthoclads skimming about in riffles like Barber describes, but never any *Diamesa.*

D. leona is quite similar to the european *steinboecki.* Serra-Tosio (1971) fully describes *steinboecki,* and it is clear that *leona* is not the same species. The hypopygium in *steinboecki* (Serra-Tosio, 1971: Pl. 75) has a fine, long, posteriorly-directed anal point, although in other characters it is quite close to *leona.*

The two specimens from Minnesota and New Brunswick differ from western specimens in LR, BV, and SV. They also lack the apical teeth on the tarsal claws.

The hypopygial figure of *D. leona* is reduced about 1.5 times more than that of *leoniella;* the hypopygium in *leona* is actually considerably larger than that of *leoniella.*

Location of types. — Holotypes of *D. leona, pieta,* and *caena* are at the ANSP; paratypes of these are at the ANSP and USNM. I would like to thank Dr. Roback again for letting me borrow these types and Dr. Serra-Tosio for sending me specimens of *D. steinboecki.*

Diamesa leoniella new species

Description (unless otherwise stated, n = 5 and measurements are in microns): as in *D. amplexivirilia* except:

Total length. — 3.7 (3.3-4.1) mm.

Coloration (alcohol specimens). — entire body light to dark brown; scutum darkest along dorsocentral setal rows and along midline, with lighter lateral and antero-medial stripes; haltere knob and shaft white, base slightly light brown.

ANTENNA. — 8 flagellomeres, rarely with partial fusion of $Flm_{1 \& 2}$ or $Flm_{6 \& 7}$; non-plumose, longest flagellar seta (on Flm_8) $0.16\text{-}0.17L_{fl}$; $Flm_{2 \& 3}$ irregularly fusiform, $Flm_{4\text{-}7}$ subglobose, Flm_8 cylindrical in basal 0.8-0.9, tapering beyond to blunt apex; flagellar setae short (MaxL 73-88), setae 4-8 on Flm_1, 0-5 on $Flm_{2\text{-}3}$, 0-4 on Flm_4, 1-3 on Flm_5, 0-1 on Flm_6, 0-3 on Flm_7, 5 on Flm_8; whorl of setae at about 0.7 of Flm_1 (often with 1-2 additional setae at about 0.5), at 0.3-0.5 of $Flm_{2\text{-}7}$, at 0.1 of Flm_8. Antennal sensilla as follows (n = 2); large, blunt sensillum basiconicum 1 on $Flm_{1\text{-}7}$; slightly smaller, blunt sensilla basiconica 1-2 on Flm_1, 2-5 on Flm_2, 5-7 on Flm_3, 6-8 on Flm_4, 7 on Flm_5, 5-7 on Flm_6, 5-8 on Flm_7, 2 on Flm_8: long, pointed sensilla basiconica 0-1 on $Flm_{4 \& 5}$, 2-3 on Flm_6, 3-7 on Flm_7, very numerous on Flm_8; ringed sensilla coeloconica 2 on Flm_1, 1 on Flm_2, 0-1 on Flm_3, 3-4 on Flm_8; small sensilla coeloconica 2 on Flm_1, 1 on Flm_2, 0-1 on Flm_3, 3 near apex of Flm_8. $\overline{L}_{flm_{1\text{-}8}}:\overline{W}_{flm_{1\text{-}8}}$ 98:35, 35:33, 34:32, 26:31, 27:31, 26:32, 25:32, 117:38; AR 0.59 (0.48-0.74); 2 (occasionally 1) subequal preapical antennal setae; length of longer PAS 34 (27-39); D_{pd} 76 (68-85); pedicellar setae absent; H_{sc} 65 (59-73); scape with microtrichia and sometimes with single dorso-lateral seta; dorsal or dorso-lateral region of scape sometimes poorly sclerotized.

HEAD. — Fig. 54. W_h 456 (426-502); coronal suture usually completely absent, occasionally with just a short trace at level of vertex projections over scapes; coronal triangle absent; vertex not sunken dorso-medially; vertex with usual 4 short setae in large, clear sockets dorso-medially; rear margin of vertex produced dorsad at midline to form small, clear, triangular or rectangular nape; reduced ocelli fairly far apart, on or just above vertex projections over scapes, slightly to well below level of tops of antennal sockets; epistomal suture moderate, complete or interrupted laterally; interocular setae easily distinguishable from inner verticals, forming fairly distinct group centered at 0.4-0.5 of distance from dorso-medial margin of eye to midline of vertex; IOS/side 4 (3-6); postocular setae in uniserial or slightly staggered row running just behind posterior margin of eye from near postero-ventral eye margin to merge with about 2-4 longer and much stronger outer vertical setae; PtOS/side 6-9; inner and outer verticals not well differentiated, both strong, stout, dispersed on vertex dorsad and dorso-mesad to dorso-medial corner of eye; inner verticals occurring well below dorsal margin of eye anteriorly, reaching to 0.31-0.50 of distance from dorso-medial margin of eye to midline of vertex. CS 4 (2-8). Tentorium not swollen anterolaterally at base, with weak to moderate postero-medial basal projection; tentorium weakly or not at all extending past PTP. Eyes with dorso-medial margin broadly truncate to broadly rounded; H_e 218 (203-227); ventral ocular apodeme absent or very small. PS_1 with 0-2 setae, subglobose or squatly cylindrical, about as well sclerotized as other palpal segments; $\overline{L}_{ps_{2\text{-}5}}:\overline{W}_{ps_{2\text{-}5}}:\overline{MaxL}_{pss_{2\text{-}5}}$ 69:42:53, 105:44:45, 92:35:41, 132:26:19; D_{so} 18-20; CP 1.18 (1.10-1.24); palpal stoutness 2.64 (2.34-2.84). Cibarial pump wider than high, sides straight or slightly concave, with fairly long, slender, pointed cornua.

THORAX. — Fig. 86. L_{th} 1.01 (0.95-1.11) mm, D_{th} 0.90 (0.87-0.97) mm. Antepronotum with medial commissure absent; antepronotal notch ranging from very short, acute, and beginning behind fore margin of scutum, to right angled to sometimes partially obliterated by fusion of antepronotal lobes; medial corners ranging from nearly obliterated to obtuse, scarcely or not surpassing anterior margin of antepronotum; lateral antepronotal setae dispersed medially, region of lateral setae

strongly swollen; LAS/side 14 (10-17). Scutum in side view flattened, indented approximately above parapsidal suture and again just before anterior end of scutum, usually extending beyond fore margin of antepronotum. DCS/side 6 (1-9) (note range!), $MaxL_{dcs}$ 91 (79-99); short but strong, decumbent acrostichal setae often present, about at midpoint of scutum, at anterior end of broadening of medial scutal scar; AcS 0-5. Prealar setae strong, stout, in rather long, staggered row on posterodorsal region of prealar callus; PAS/side 6 (3-7); scutal angle strong, rounded; parapsidal suture fairly straight, with internal apodeme; humeral scar an irregular tuberose area anterior to dorsal end of parapsidal suture; medial scutal scar faint or absent anteriorly, expanding at about the midpoint of scutum, disappearing at end of DCS rows. Scutellar setae dispersed or in 3 irregular rows; ScS 22 (17-32) (n = 5), $MaxL_{scs}$ 89-109 (n = 3). Medial cleft of postnotum absent or very short; postnotum with suture on midline posteriorly and with rounded or slightly angled posterodorsal margin. Anteanepisternal pit a small but fairly well defined oval; medioanepisternum II somewhat narrowed and pointed ventrally, usually not completely delimited from anteanepisternum; ASR 0.48 (0.44-0.52); setae on epimeral II protuberance absent, protuberance weak, broadly rounded; no setae elsewhere on epimeron II; 0-3 (usually 1) short setae just below anapleural suture on preepisternum II.

WING. — L_w 2.5 (2.4-2.6) mm, W_w 0.84 (0.78-0.92) mm. Outline as in Fig. 99. Wing margin usually slightly concave at or just beyond end of R_1, at end of M_{3+4}, and proximal to end of Cu_1, straight or slightly concave distal to anal lobe; anal lobe slightly obtuse. Dry wing not available. Slide mounted wing showing: marginal setal fringe in 2 rows along proximal 0.2 of C, becoming more or less in 3 or even 4 rows on distal 0.8 of C, then becoming more or less alternating long-short past distal end of costa, longest on anal lobe. Costal projection 51 (30-67) or 2.1 (1.2-2.8) times its width; r-m strong, slightly to moderately arched, mainly arched proximally; base of r-m distal to apparent m-cu by about width of r-m. Vestige of ?R_5 appearing as faint, diffuse, ill-defined band just anterior to distal 0.3 of M_{1+2}; vestige of ?M_2 appearing as faint, diffuse, ill-defined band just posterior to distal 0.6 of M_{1+2}; VR 0.95 (0.92-0.99). Remigium with 1 strong or 1 strong and 1 weak seta on hand, 0-1 weak seta and about 8-14 campaniform sensilla just beyond wrist, and 2 setae and 2-4 large and about 6-8 smaller campaniform sensilla on distal 0.5 on forearm. Setae 11 (8-14) on R, 11 (9-13) on R_1, 14 (10-16) on R_{4+5}, and occasionally 1 on r-m. Campaniform sensilla 2-3 ventrally on Sc just beyond arculus, 1 dorsally on R_1, 1 (occasionally 0) dorsally and 1 ventrally near base of R_{2+3}, and 0 on R_{4+5}. Squama with 12 (8-15) setae, $MaxL_{sqs}$ 68 (50-85).

LEGS. — Spiniform setae on first 3 tarsomeres on P I-III as follows: 2 (apical), 2 (apical), 2 (weak, apical); 10-13, 4-7, 2 (apical)-4; 12-22, 7-10, 2 (apical)-4. Tm_4 only slightly cordiform, with slightly swollen, membranous, apical sole ventrally; articulation of Tm_5 distinctly proximal to apical margin of Tm_4, but dorso-lateral region of Tm_4 only slightly or not at all constricted just before apex. Lengths and ratios of leg segments as follows:

	Fe	Ti	Tm_1	$Tm_{2\text{-}5}$	LR	BV	SV
P_I	1770 (1660–1890)	1780 (1680–1930)	1140 (1010–1240)	1140 (1090–1220)	0.64 (0.60–0.66)	4.10 (4.03–4.19)	3.12 (3.01–3.37)
P_{II}	1840 (1720–1990)	1560 (1500–1720)	800 (760–870)	880 (820–1030)	0.50 (0.49–0.51)	4.17 (3.93–5.14)	4.30 (4.20–4.37)
P_{III}	1920 (1830–2060)	1860 (1720–2010)	1140 (1090–1210)	1230 (1160–1360)	0.61 (0.60–0.63)	3.99 (3.79–4.16)	3.32 (3.25–3.42)

HYPOPYGIUM (without reference to *amplexivirilia*). — Fig. 118. Tg IX with 10 (6-13) setae/side. Anal point fairly short but strong, wedge-shaped, without apodemes on underside of Tg IX; anal point with numerous coarse microtrichia on basal 0.5. L_{gncx} 400 (384-421); $\overline{L}_{tot}$:$\overline{L}_{gncx}$ 9. Basal plate weakly developed, with distinct disto-medial projection. Medial field only weakly developed; gonocoxite with moderate ridge dorso-medially. Gonostylus with numerous, short, proximally-directed setae; medial surface of gonostylus with fine "pile" of microtrichia. Sternapodeme very strong, produced to a point antero-medially. Basal wedge fairly well developed, rugose laterally.

DIAGNOSIS. — Fairly strong anal point, gonostylus with "pile" on medial surface.

MATERIAL EXAMINED. — *California,* Convict Creek, 7,200′, 13 Feb. 1963, H D Kennedy, *Diamesa leona* Roback ♂ [det. ?], 1 male (USNM); *Montana,* Glacier National Park, Logan Creek at Going to the Sun Highway, 5,800′, light trap, 23 July 1968, leg. Ron Hellenthal, 40 males; as above, but drift net in Logan Creek, 3 males (UMn); *Utah,* Daggett County, Sheep Creek cave stream at jct. with Sheep Ck., 7 mi. above jct. with Green R., IV-3-65, A. V. Nebeker, 1 male (UMn); Salt Lake County, various localities along Big Cottonwood Creek, Nov., Dec., 1964, Jan., Feb., March, April, June 1965, about 70 males, 8 females (ANSP); [*Washington*], Columbia R., 2.V.1952, 24.VI.1952, 14 pupae, 3 males (CNC); *Wyoming,* 44°58′26″N, 109°33′12″W, alt. 9,640′, 32 mi. N, 24 mi. W of Cody, small stream feeding unnamed lake, water 14°C., 9 Aug. 1969, leg. Dean Hansen, 42 males, 8 females, about 12 pupae in silk and sand cases, many larvae (UMn); 44°57′50″N, 109°29′12″W, alt. 10,300′, 31 mi. N, 21 mi. W of Cody, small steep stream feeding Frozen Lake, 13 Aug. 1969, leg. Dean Hansen, 3 males (UMn).

DISCUSSION. — *D. leoniella* has some noteworthy morphological characters. First, it is the only *Diamesa* I have come across which often has a dorso-lateral seta on the scape. It also often has one or two setae on the first palpal segment, and the coronal suture is completely absent in most specimens (Fig. 54). *D. leoniella* is also the only *Diamesa* I know of which often has at least one acrostichal seta (one specimen had five). One specimen had only one dorsocentral seta on one side, so I think it's

possible that an occasional specimen could have no dorsocentrals and yet have one or more acrostichals.

Most of the adults of *leoniella* I collected were taken by turning over rocks at the edge of or just in the stream shown in Fig. 32. The adults were often found in congregations on the protected sides of rocks, just above the splash line.

LOCATION OF TYPE. — The holotype is an adult male I collected in the Bear Tooths in Wyoming (44°58′26″N, 109°33′12″W, alt. 9,640′, 32 mi. N, 24 mi. W of Cody. Small stream feeding unnamed lake, water 14°C., 9 Aug. 1969, leg. Dean Hansen, under rocks in stream, slide DH70-97). The other specimens examined are designated as paratypes and are returned to their respective institutions.

Diamesa lindrothi Goetghebuer

D. lindrothi Goetghebuer, *in* Goetghebuer and Lindroth, 1931: 279, 281 (described from males and females from Iceland; description, figure of hypopygium); Edwards, 1935: 471 (records 1 male, 1 female from Lake Fjord, East Greenland); Thienemann, 1941: 66, 68, 70, 78, 79, 82, 148, 188-189 (larvae and pupae from Norway and Swedish Lappland); Pagast, 1947: 473, 474-475; Abb. 32; 523-524, 550, 551, 572, 579, 580, 591 (description of adult male, possible female pupa, discussion of "species pairs"); Thienemann, 1950b: 542, 543, 564, 565 (distribution from the literature); Thienemann, 1952: 253 (larva, with fair description, in key); Thienemann, 1954: 23, 31, 44, 45, 46, 48, 344, 346, 355, 357 (ecology of larvae); Wuelker, 1959: 355 (mention of *lindrothi* in discussion of zoogeography); Styczynski, B. and S. Rakusa-Suszczewski, 1963: 329, 330, 331, 333-334 (description, habitat of larvae from Spitsbergen); Serra-Tosio, 1964: 40, 41, 42 (discussion of *latitarsis* group); Serra-Tosio, 1966: 124, 125, 126 (records from French Alps, showing *lindrothi* is indeed boreoalpine in distribution); Serra-Tosio, 1967b: 78-81 (description of male adult and pupa; figure of hypopygium; distribution; ecology of larva); Saether, 1968: 456 (records from Finse area, Norway; brief description, figure of hypopygium); Serra-Tosio, 1969a: 205 (records 2 males from Swedish Lapland, in Brundin collection); Steffan, 1971: 477, 480, 483, 484, 485 (distribution, ecology of larvae in glacial streams in northern Scandinavia); Serra-Tosio, 1971: 174-178, Figs. 61.8, 64.8, 65.3, 65.9, 65.15, 68.3, 69.3, 156, 173 (distribution, description of male adult and pupa).

[?] *Brachydiamesa sp. II.* Thienemann, 1936: 206-207 (description of larvae from Partenkirchen; possibly *latitarsis, fide* Pagast, 1947: 473); Thienemann, 1937b: 2-3 (records larvae from standing and flowing water in East Greenland; possibly *latitarsis, fide* Pagast, 1947: 473).

Description (unless otherwise stated, n = 4 and measurements are in microns): as in *D. mendotae* except:

TOTAL LENGTH. — 3.4 (3.0-3.7) mm (n = 5).

COLORATION. — not noted before slide mounting.

ANTENNA. — longest flagellar seta 0.63 (0.56-0.69)L_{fl}; $Flm_{2\text{-}4}$ moderately fusi-

form, Flm_{5-12} progressively become less fusiform, but Flm_{12} usually at least slightly fusiform; Flm_{13} with apical 0.29-0.37 spindle-shaped, mainly swollen ventrally; 0(?)-2 short, slender setae dorso- and ventro-medially on Flm_1; long (MaxL 515-687) flagellar setae 0-1 on Flm_1, 2-3 on Flm_2, about 6 on Flm_3, about 9 on Flm_4, increasing to 11-13 on Flm_{12}, numerous on Flm_{13}; setae on basal 0.2-0.3 of spindle-shaped region of Flm_{13}; medial seta-free area reduced, extending only to $Flm_{10 \text{ or } 11}$, not infolded in slides available; 1 small, blunt sensillum basiconicum/flagellomere ventrally at least on $Flm_{2 \,\&\, 3}$, possibly present on Flm_1 but not visible in slides available; spindle-shaped region of Flm_{13} with numerous slender, pointed sensilla basiconica, but apparently without or with only 1 blunter, shorter sensillum basiconicum arising from more distinct pit, and with 4-5 ringed sensilla coeloconica; $\overline{L}_{flm_{1-13}} : \overline{W}_{flm_{1-13}}$ 73:41, 21:39, 26:37, 30:35, 34:34, 37:33, 38:31, 41:31, 45:29, 45:27, 44:28, 47:28, 417:26; AR 0.82 (0.75-0.86); 1 preapical antennal seta; L_{pas} 30 (26-34); D_{pd} 142 (137-152); 2-3 pedicellar setae ventromedially; H_{sc} 144 (133-155).

HEAD. — W_h 528 (499-564); interantennal bar thin, weak, but still complete; epistomal suture moderate medially, only slightly weaker laterally; IOS/side 2-4; postocular setae ranging from 3-5/side, running uniserially just mesad to ventral 0.5 of rear margin of eye, to about 8-10/side, running more or less uniserially to almost merge with about 3 stronger, longer outer verticals; inner vertical setae few, shorter, weaker, more curved and decumbent than outer verticals, running roughly in row or slightly dispersed on antero-dorsal region of vertex; inner verticals reaching to 0.61 (0.53-0.78) of distance from dorso-medial margin of eye to midline of vertex. CS 6 (4-7). Tentorium moderately swollen antero-laterally at base, not or only very slightly swollen at PTP, extending well beyond PTP. Eyes not hairy, microtrichia visible medially as minute points at antero-medial margin, not visible laterally; dorso-medial margin extending not quite as far mesad as ventro-medial margin; H_e 231 (213-254); ventral ocular apodeme moderate, more slender and weaker than in other species. PS_1 without setae, subglobose, nearly as well sclerotized as other palpal segments; $\overline{L}_{ps_{2-5}} : \overline{W}_{ps_{2-5}} : \overline{MaxL}_{pss_{2-5}}$ 65:34:75, 112:40:67, 123:29:35, 156:23:25; sunken organ inconspicuous, at about 0.7 of PS_3; D_{so} 12 (10-14); CP 1.16 (1.10-1.25); palpal stoutness 3.61 (3.30-3.87).

THORAX. — L_{th} 1.00 (0.80-1.09) mm, D_{th} 0.98 (0.88-1.02) mm. All thoracic sclerites covered with very fine microtrichia. Antepronotum with medial commissure strong, not quite reaching rear margin of phragma I, reaching to or slightly surpassing anterior margin of scutal process; antepronotal notch right-angled or obtuse, with medial corners broadly rounded and only slightly to moderately surpassing scutal process; LAS/side 6 (4-7). Post-pronotal apophyses slender, moderately developed. Dorsocentrals uniserial; DCS/side 9 (7-11) (n = 4), $MaxL_{dcs}$ about 150 (n = 2); 1 specimen with 1 well-developed acrostichal seta at about 0.25 length of scutum; PAS/side 6 (4-8); medial scutal scar faint, interrupted anteriorly, otherwise as in *D. mendotae;* scutellar setae dispersed or very roughly in 2 rows, ScS about 20, $MaxL_{scs}$ not measurable in slides available. Postnotum with well-developed medial cleft, postnotum viewed laterally with smoothly rounded postero-dorsal margin. Medioanepisternum II usually not or sometimes only very weakly delimited ventrally; ASR 0.62-0.64 (n = 3); 0 or 1 fine seta on epimeral II protuberance.

WING. — L_w 2.20-2.77 mm, W_w 0.78-0.92 mm. Rear margin only very slightly concave proximally, anal lobe broadly rounded and about right-angled. Dry wing

not available. Slide mounted wing showing: microtrichia visible as numerous, fine, close points at 150×, as very short hair-like projections arising from minute points or dots at 650×. Costal projection fading gradually, roughly 36-60, or 3-6 times its width; R_1 not or only slightly enlarged distally. R_{2+3} fairly strong proximally, distal 0.3 becoming very faint, proximal 0.4 running slightly closer to R_{4+5} than to R_1;vestige of ?M_2 just barely visible just posterior to distal 0.8-0.9 of M_{1+2}; VR 0.92-0.94. Remigium not visible in slides available. Setae 9-17 on R, 10-13 on R_1, and 3-5 on R_{4+5} (uniserial and dorsal on all). Campaniform sensilla 3 ventrally on Sc just beyond arculus, 1 dorsally on R_1, 1 dorsally and 1 ventrally near base of R_{2+3}, and 0 on R_{4+5}. Squama (n = 2) with about 16-20 setae, $MaxL_{sqs}$ 76-129.

LEGS. — $\bar{L}_{p_I}:\bar{L}_{tot}$ 1.10; Fe I with postero-dorsal beard not visible in slides available. Apical spur of Ti I long, slender, with sparse prickles on basal 0.4; L_{tispI} 57-69; apical spurs of Ti II stouter, subequal in length, with fairly numerous prickles on basal 0.4-0.5; L_{tispII} 38-48, 45-55; apical spurs of Ti III with somewhat sparse to fairly numerous prickles on basal 0.4-0.6; $L_{atispIII}$ 40-55, $L_{ptispIII}$ 64-79. Weak polygon pattern not visible near apex of Ti I; polygon pattern on Ti III very weak. Ti III with posterior comb of about 10-12 spines arranged in a single regular row. Spiniform setae on first 3 tarsomeres of P I-III as follows: 0-2 (apical), 0, 0; 2 (apical)-5, 2 (apical), 0-1 (at about 0.5); 3-7, 2 (apical), 0. Lengths and ratios of leg segments as follows:

	Fe	Ti	Tm_1	Tm_{2-5}	LR	BV	SV
P_I	1000 (890–1140)	1110 (1000–1190)	810 (750–860)	807 (720–870)	0.73 (0.71–0.75)	3.63 (3.56–3.65)	2.60 (2.50–2.73)
P_{II}	1190 (940–1210)	1020 (900–1130)	490 (450–540)	590 (530–640)	0.49 (0.47–0.50)	4.37 (4.20–4.50)	4.28 (4.13–4.34)
P_{III}	1220 (1080–1380)	1220 (1090–1290)	770 (710–820)	770 (690–860)	0.64 (0.60–0.65)	4.18 (4.06–4.28)	3.16 (3.04–3.28)

HYPOPYGIUM (without reference to *D. mendotae*). — Fig. 137. Tg IX with 3-6 setae/side. Anal point slender, broadening basally, usually with short apical peg set in small depression; strong apodemes on underside of Tg IX diverging and arching slightly to antero-lateral corners of Tg IX; L_{gncx} 250 (243-267); $\bar{L}_{tot}:\bar{L}_{gncx}$ 14. Basal plate scarcely developed. Medial field not developed. Gonocoxite with finger-like, setous projection present just posterior to basal foramen and stronger basi-medial projection with several very stout setae. Gonostylus fairly long, slender, with single subterminal peg and minute terminal ridge. Sternapodeme a simple slender arch. Basal wedge fairly well developed, rugose.

DIAGNOSIS. — Antenna plumose, eyes not hairy; gonocoxite with finger-like appendage and stronger appendage basi-medially. No other nearctic *Diamesa* has similar appendages. Other related European species are described in Serra-Tosio, 1967b.

Material examined. — *Austria,* Obergurgl, TIROL, 1950m, 8, 25-VIII-1953, J. R. Vockeroth, 5 males (CNC); *East Greenland,* Lake Fjord, 66.17.N, 34.59.W., 16.VIII.1933, F. S. Chapman, B. M. 1933-645, 1 male (BMNH).

Discussion. — *D. lindrothi* is the only member of the *latitarsis*-group, i.e., *latitarsis, goetghebueri, lindrothi, modesta, wuelkeri,* and *laticauda* (Serra-Tosio, 1967b), reported thus far from the Nearctic. I never collected the species; the only nearctic specimen I saw was that recorded from East Greenland by Edwards (1935).

Location of type. — Unknown to me.

Diamesa mendotae Muttkowski

D. mendotae Muttkowski, 1915: 116-122 (described from larvae, pupae, and adults from creeks feeding Lake Mendota, Wisconsin); Johannsen, 1921: 230, 231, 232 (adults and larvae in key; brief description of larvae); Johannsen, 1952: 13 (as possible junior synonym of *D. nivoriunda* (Fitch)).

Description (unless otherwise stated, n = 5 and measurements are in microns):

Total length. — 5.0 (4.2-6.0) mm.

Coloration (pinned specimen). — head and thorax dark gray, pruinose; scutal stripes darker, less pruinose, particularly when viewed antero-dorsally. Legs and abdomen dark gray-brown; hypopygium dark gray. Haltere base and much of shaft brown; capitellum light brown to nearly white.

Antenna. — Figs. 36, 37, 39. 13 flagellomeres, plumose; longest flagellar seta 0.61 (0.54-0.66)L_{fl}; distal 0.5 of Flm_1 slightly swollen, particularly ventrally, Flm_1 with basal nipple; Flm_{2-3} slightly fusiform, Flm_{4-12} progressively becoming cylindrical; Flm_{13} usually evenly tapering very slightly toward apex; Flm_{13} with apical 0.15-0.20 spindle-shaped, mainly swollen ventrally; 1-3 short, slender setae dorso- and ventro-medially on Flm_1; short setae becoming more numerous (to maximum of about 5 on Flm_3) and progressively longer and stronger on following Flm's until indistinguishable from long setae by $Flm_{6 \text{ or } 7}$; long (MaxL 520-950) flagellar setae 0-1 on Flm_1, 2-7 on Flm_2, 6-12 on Flm_3, increasing to 13-15 on Flm_{12}, numerous on Flm_{13}; on Flm_{13} setae longest proximally, diminishing in length to about 120 long near apex; setae not on or only on basal 0.2 of spindle-shaped region of Flm_{13}; antennal plume not reaching apex of Flm_{13}; long setae in irregular whorl on Flm_2, in 2 irregular whorls on Flm_{3-12}, dispersed on Flm_{13}; antennal furrow extending from Flm_1 to apex of Flm_{13}, usually infolded from Flm_5 to just before apex of Flm_{13}; medial seta-free area extending from Flm_1 to Flm_{12}, not infolded; 1 blunt sensillum basiconicum/flagellomere just ventral to antennal furrow on Flm_{1-5} (appearing as clear spot under bright field); 1 slightly smaller, blunt sensillum basiconicum/flagellomere ventrally on Flm_{1-3}; small sensilla coeloconica 2 ventrally on Flm_1, 1 ventrally on $Flm_{2 \,\&\, 3}$; 1 ringed sensillum coeloconicum dorsally, 1 ventrally on Flm_1, 1 dorsally on Flm_2; spindle-shaped region of Flm_{13} with about 20-35 slender, pointed sensilla basiconica, about 3-5 blunter, shorter sensilla basiconica arising from more distinct pits than the preceding, and about 4 ringed sensilla coeloconica; 3-5 small sensilla coeloconica (Fig. 42) at very apex of Flm_{13}. $\overline{L}_{flm\,1-13} : \overline{W}_{flm\,1-13}$ 100:64, 23:

55, 24:54, 25:50, 23:47, 25:46, 25:45, 26:46, 28:46, 29:44, 32:45, 34:43, 904:41; AR 2.06 (1.98-2.15); 1 (rarely 2) preapical antennal seta; L_{pas} 49 (42-59); pedicel (Fig. 36) globose, with fine microtrichia; D_{pd} 188 (173-200); 1 (rarely 2) pedicellar seta ventro-medially; 1 campaniform sensillum (Fig. 5) dorsally at ridge of indentation for Flm_1; scape ring-like, complete, with articulation to pedicel ventro-medially and dorso-laterally (Fig. 48); H_{sc} 205 (180-221); scape without setae or microtrichia.

HEAD. — Figs. 48, 49. W_h 719 (666-768); coronal suture strong, reaching to antennal sockets, bifurcating well before rear margin of vertex, with strong coronal apodeme; vertex slightly sunken at arms of coronal suture; 4 short, stout coronal setae in large, clear sockets on coronal triangle; rear margin of coronal triangle produced dorsad at midline to form small, triangular nape; vertex well delimited from antennal sockets, slightly produced medially toward frons, not projecting anteriorly over scapes; dorsal ocular apodeme (Fig. 6, 54) absent to moderate; reduced ocelli close together, at antero-medial margin of vertex; inter-antennal bar strong, continuous with coronal suture and frons; frons fairly well delimited from antennal sockets; epistomal suture strong medially, usually weaker laterally; interocular setae in distinct group centered near dorso-medial margin of eye; IOS/side 5 (3-7); postocular setae in uniserial row running from near postero-ventral margin of eye dorsally to merge with about 6 stronger, longer outer vertical setae (Fig. 49); PtOS/side 10-16; inner vertical setae shorter, weaker, more curved and decumbent than outer verticals, dispersed on dorsal region of vertex; inner verticals reaching to 0.33-0.62 of distance from dorso-medial margin of eye to midline of vertex; no vertex hump behind eye. Clypeus slightly swollen anteriorly, slightly wider than long (Fig. 48); clypeal setae dispersed; CS 10 (5-14). Labrum not sclerotized. Tentorium (Fig. 60) swollen antero-laterally at base, slightly swollen at PTP, extending moderately beyond PTP. Eyes hairy, microtrichia about twice height of ommatidial lens; dorso-medial margin truncate, dorsal corner rounded; dorso-medial margin extending about as far mesad as ventro-medial margin; H_e 324 (298-350); ventral ocular apodeme very prominent (Figs. 48, 60); antennifer present (Fig. 60). Palpus 5-segmented; PS_1 (Figs. 48, 51) without setae, subglobose, slightly less well sclerotized than other palpal segments; $PS_{2\text{-}5}$ setous (longest setae laterally), PS_3 slightly swollen disto-medially; $\overline{L}_{ps_{2\text{-}5}} : \overline{W}_{ps_{2\text{-}5}} : \overline{MaxL}_{pss_{2\text{-}5}}$ 102:45:119, 167:53:107, 141:45:97, 216:35:32; sunken organ (Figs. 7-9) prominent, at about 0.7 of PS_3; D_{so} 18 (16-20); all palpal segments with grouped microtrichia; CP 1.13 (1.09-1.19); palpal stoutness 3.59 (3.42-3.76). Cibarial plate rectangular, with fairly long, slender cornua (Fig. 58); orifice prominent. Stipes as in Fig. 56.

THORAX. — Figs. 64-66. L_{th} 1.30 (1.07-1.56) mm, D_{th} 1.20 (0.97-1.45) mm. All thoracic sclerites covered with fine microtrichia. Antepronotum with medial commissure very strong, in dorsal view reaching to or nearly to rear margin of phragma I, reaching to or slightly surpassing anterior margin of scutal process (Fig. 78); antepronotal notch varying from obtuse, with medial corners broadly rounded and scarcely surpassing scutal process (Fig. 85), to fairly acute, with medial corners moderately right-angled and well surpassing scutal process (Fig 83; intermediate forms in Figs. 78, 84); anterior margin of antepronotum straight or slightly concave; lateral antepronotal setae restricted to near lateral edge; LAS/side 7 (4-9). Postpronotum fused with scutum antero-dorsally, but well delimited postero-dorsally, fused with anteanepisternum ventrally; postpronotum without setae, but with 2 small,

indistinct sensilla (?) on antero-dorsal border (Fig. 64); postpronotal apophyseal pit appearing as a clear oval; postpronotal apophyses strong (Fig. 78). Scutum in side view flat or slightly concave posteriorly, moderately arched medially and anteriorly; scutal process well developed; dorsocentrals ranging from completely uniserial to irregularly biserial or staggered posteriorly (Figs. 79-82); a few tiny, clear dots (sensilla?) present in or just beside DCS row; DCS/side 13 (8-24), $MaxL_{dcs}$ 172 (146-220); acrostichals absent; prealars all in lightly sclerotized postero-dorsal region of prealar callus; PAS/side 7 (5-8); supraalars absent; scutal angle moderate (Fig. 78); parapsidal suture arched, with internal apodeme; humeral scar a roughened oval just anterior to dorsal 0.2 of parapsidal suture; faint, narrow medial scutal scar running from scutal process to near mid-point of scutum, there expanding to form broader, pale scar which narrows and fades near ends of DCS rows; microtrichia much longer in this expanded region; scutellar setae dispersed or roughly in 2 long (posterior) and 1 short (anterior) row; ScS 35 (23-60), $MaxL_{scs}$ 229 (186-341). Postnotum with medial cleft reaching to near moderately sharp postero-dorsal corner (Fig. 65, 73); postnotum with short medial suture postero-ventrally (Fig. 72). Ante-anepisternal pit ill-defined ventrally; medioanepisternum II delimited completely, rounded ventrally; anapleural suture strong; ASR 0.59 (0.55-0.62); 1 or 2 fine setae on epimeral II protuberance; no other setae on any pleural sclerite.

WING. — L_w 3.6 (3.2-4.0) mm, W_w 1.09 (0.97-1.17) mm. Outline as in Fig. 93. Rear margin slightly concave just distal to anal lobe, anal lobe slightly acute. Dry wing showing: vestige of $?R_4$ as weak concave fold running approximately parallel to R_{4+5} from about fR to wing tip; vestige of $?R_5$ as convex fold running just anterior to M_{1+2} from about fR to wing margin; vestige of $?M_2$ as convex fold just posterior to M_{1+2}; sharp concave fold running midway between M and Cu from arculus through apparent m-cu to merge with vestige of $?M_3$, the latter running just anterior to M_{3+4} from apparent m-cu to wing margin; a weak concave fold running between M_{3+4} and Cu_1, bifurcating distally; strong concave vannal fold running from base of Cu nearly to wing margin; weak concave fold posterior to An. Slide mounted wing showing: microtrichia visible as numerous, close points at 150×, as short, seta-like projections arising from tiny points or dots at 650×. Membrane without setae. Marginal setal fringe more or less in double row along fore margin of costa, becoming alternating long-short past distal end of costa, longest on anal lobe. Costa becoming easily discernible just before humeral cross-vein, gradually increasing very slightly in width distally; costa ending slightly before tip of wing, about at level of end of M_{1+2}; costal projection (Fig. 145) 107 (98-119) or 5.9 (5.0-7.5) times its width; Sc appearing as sharp concave fold proximally, becoming very weak beyond forking of R, faintly reaching C. R_1 just slightly enlarged distally. R_{2+3} fairly strong proximally, fading gradually beyond about 0.2 of its length, running about mid-way between R_1 and R_{4+5}; R_{2+3} ending much closer to tip of R_1 than to tip of R_{4+5}; R_{4+5} strong, ending before level of end of M_{1+2}. r-m strong, just slightly and fairly uniformly arched; base of r-m distal to apparent m-cu by 1-2 times width of r-m. M a mere trachea proximally, gradually becoming stronger towards apparent m-cu; M_{1+2} fading rapidly just beyond r-m; vestige of $?R_5$ just barely visible as slight discoloration just anterior to distal 0.3 of M_{1+2}; vestige of $?M_2$ just barely visible as slight discoloration just posterior to distal 0.6 of M_{1+2}; apparent m-cu little more than a trachea, approximately perpendicular to Cu and M; apparent m-cu distal to apparent fCu by about 1-2 times width of apparent m-cu;

VR 0.93 (0.93-0.95); M_{3+4} weak. Cu strong, with prominent trachea visible to apparent m-cu; distal 0.2 of Cu_1 curving gently posteriorly; An weak, fading before wing margin. Remigium (Fig. 89) with 1 strong or 1 strong and 1 weak seta on hand, 1 weak seta and about 12 campaniform sensilla just beyond wrist, and 3 (2-4) setae and 4 large (Fig. 90: arrow heads) and about 8 smaller campaniform sensilla on distal 0.5 of forearm. Setae 17 (9-23) on R, 10 (6-12) on R_1, 6 (4-10) on R_{4+5} (uniserial and dorsal on all). Campaniform sensilla 3 ventrally on Sc just beyond arculus (Fig. 90), 2 dorsally on R_1, 1 dorsally and 1 ventrally near base of R_{2+3}, and 3 or 4 dorsally on R_{4+5}. Squama (n = 3) with 38-52 strong setae, $MaxL_{sqs}$ 168-198; alula bare.

LEGS. — Legs long, slender; $\bar{L}_{p_I}:\bar{L}_{tot}$ 1.08; Fe I with sparse postero-dorsal beard of about 10-15 long setae. Apical spur of Ti I long, slender, with fairly numerous prickles on basal 0.3-0.5; L_{tispI} 87 (76-95); apical spurs of Ti II stouter, subequal to equal in length, with numerous prickles on basal 0.5-0.7; L_{tispII} 59 (50-71); apical spurs of Ti III with numerous prickles on basal 0.5-0.6; $L_{atispIII}$ 64 (52-86), $L_{ptispIII}$ 97 (86-105); all apical tibial spurs apparently with basal oval sensory dome. Weak polygon pattern often visible near apex of Ti I; polygon pattern on Ti III faint to well developed (Fig. 109). Ti III with posterior comb of about 17-20 spines arranged in a fairly regular single row (Figs. 21, 109). Apical 0.5 of posterior surface of Ti III with numerous stout spine-like setae (Figs. 21, 22, 109); these setae fewer proximally, gradually increasing in number distally. Spiniform setae on first 3 tarsomeres of P I-III as follows: 5-8, 2 (apical), 0; 9-13, 3-7, 0; 10-18, 7-9, 0-2 (at about 0.6). Tm_4 cordiform, with slightly swollen, membranous, apical sole ventrally; articulation of Tm_5 distinctly proximal to apical margin of Tm_4, dorso-lateral region of Tm_4 distinctly constricted just before apex. Claws slightly expanded apically, with about 7-10 apical teeth (Figs. 23, 24); 3-5 slender spines arising from base of claws. Empodium long, curving up between claws, with numerous long, slender, curved spines (Fig. 23). Lengths and ratios of leg segments as follows:

	Fe	Ti	Tm_1	$Tm_{2\text{-}5}$	LR	BV	SV
P_I	1570 (1360–1690)	1780 (1460–1930)	1140 (940–1260)	1240 (1080–1340)	0.64 (0.63–0.65)	3.75 (3.50–4.30)	2.94 (2.87–3.00)
P_{II}	1710 (1480–1890)	1590 (1340–1720)	760 (620–820)	970 (860–1040)	0.48 (0.46–0.51)	4.17 (4.02–4.27)	4.36 (4.07–4.54)
P_{III}	1970 (1760–2130)	1940 (1790–2100)	1190 (960–1330)	1290 (1160–1390)	0.61 (0.59–0.65)	3.94 (3.75–4.13)	3.30 (3.06–3.54)

HYPOPYGIUM. — Fig. 130. Tg IX with 17 (10-23) setae/side. Anal point strong, fairly slender apically, broadening slightly basally, with short apical peg set in small depression; strong apodemes on underside of Tg IX nearly parallel for about half length of Tg IX, then diverging and running along fore margin of Tg IX; L_{gncx} 410 (370-445); $L_{tot}:L_{gncx}$ 12. Basal plate very well developed, with numerous strong microtrichia ventrally. Medial field well developed, with dorsal border a fairly sharp ridge just slightly free from gonocoxite; medial field with numerous microtrichia,

with setae particularly strong ventrally; distal 0.2-0.3 of medial field slender, free; medial field with 2-6 setae in proximo-dorsal corner. Basimedial setal cluster with numerous very long, strong setae radiating fan-like, setae reaching well beyond midline of hypopygium (cluster not shown in Fig. 130a). Gonostylus as in Figs. 130a-130e, with subterminal peg and short terminal ridge; shape of gonostylus quite variable, depending on orientation. Sternapodeme broad medially, with strong anterolateral projections; fore margin strongly concave medially. Basal wedge very strong, rugose, extending nearly to distal end of basal plate.

Diagnosis. — Antenna plumose, eyes hairy, basimedial setal cluster strong; the gonostylus is unlike any other species. *D. nivoriunda* is the most similar species but has a triangular gonostylus.

Material examined. — *Minnesota,* Hennepin County, Basspond, 7 Mar. 1940, D. G. Denning, R. H. Daggy, P. H. Hardin, 1 male (UMn); Houston County, Beaver Creek Valley State Park, N. J. mosquito trap, 27 April, 20 Oct. 1970, leg. E. F. Cook, 5 males (UMn); 1 mi. N of Stillwater, on snow by Brown's Creek, 4 March 1969, leg. D. Hansen, air temp. about 35°F., 4 males (UMn); Washington County, 2 mi. W, 1 mi. S of Lakeland, N. J. mosquito trap near Valley Creek, leg. E. F. Cook, 15, 23 Oct. 1971, numerous males (UMn); as above, but on snow by small creek near Valley Creek, leg. D. Hansen, 14 Feb. 1967, 29 males (UMn); as above, but on snow by Valley Creek, 31 Jan. 1967, leg. D. Hansen, 4 males; *Wisconsin,* Burnett County, 45°43′N, 92°09′W, 11 mi. E, 4 mi. S of Siren, light trap or on snow by stream, Sept. to May, 1966-1971, leg. D. Hansen, about 250 males (UMn); Columbia County, T 11 N, R 8 E, W-1/2 S7, Prentice Cr., 4-III-67, leg. R. Narf, 2 males, 3 females (JES); Crawford Co., T 10 N, R 4 W, Sec. 6, Tainter Cr., 26-I-1970, leg. R. Narf, 1 male (UMn); Iowa Co., T 6 N, R 2 E, Sec. 5, Otter Creek, 29-I-1970, leg. R. Narf, 5 males (UMn); Sauk County, Otter Creek, 15-II, 22-II, 8-III, 15-IV-1969, leg. R. Narf, 9 males (UMn); Sauk County, T 11 N, R 7 E, Sec. 22-23, Parfrey's Glen, 19-XI-1966, 13-III-1969, leg. R. Narf, 7 males (UMn); Sauk County, T 11 N, R 6 E, S 32-33, Otter Creek, 27-III-1967, leg. R. Narf, 1 male (JES); Sauk County, Parfrey's Glen, 4-III-1967, leg. R. P. Narf, 13 males (JES); Waushara County, W. Br. White River, T 13 N, R 10 E, S 10, 9-II-67, leg. R. Narf, 7 males (JES); Waushara County, Mecan R., T 18 N, R 9 E, S 16, 9-II-67, leg. R. Narf, 4 males (JES); as above, but at Hy. 21 bridge, 9-II, 1-III-1967, 11 males (JES).

Discussion. — *D. mendotae* was described from larvae, pupae, and adults from streams feeding Lake Mendota at Madison, Wisconsin. The hypopygial figure drawn by Muttkowski shows a very well developed basimedial setal cluster and long anal point. The shape of the gonostylus is also reasonably clear and I feel fairly certain that the species I am calling *mendotae* is actually that described by Muttkowski.

D. mendotae is the species commonly encountered when collecting in Minnesota and Wisconsin, and I have long series of specimens. One can find a large variation in several characters when specimens from different localities and different emergence dates are examined. The number of

dorsocentral setae, for example, varies considerably both in number (i.e., by a factor of 3, or from 8 to 24) and arrangement (Figs. 79-82). The shape of the gonostylus also varies quite a bit, although the gonostylus is quite irregularly shaped and appears quite different from different angles. It is possible that what I have called *mendotae* may be two or more species; the gonostyli in Figs. 130b and 130e are certainly different from those in 130d. Until I can rear more specimens, however, I would not consider splitting my material into any new species.

Larvae of *mendotae* from rocks, gravel, and vegetation are collected in running water of streams. The species emerges from September to May and is easily collected walking about on the snow by streams or resting on the branches of nearby alders or other shrubs. On warmer nights in the fall and spring it readily comes to light traps.

LOCATION OF TYPES. — Muttkowski (1915: 121) states that the holotype male, allotype female, and larvae, pupae, and exuviae were deposited in the Milwaukee Public Museum. I contacted Mr. James Lawton of that Museum, and he kindly searched the Museum's collection for the types of *mendotae* for me. He was unable to find any of Muttkowski's material, however, nor has it turned up at any other collection. It may be that it's still extant, but I do not know of its whereabouts.

Diamesa nivicavernicola [8] new species

Description (unless otherwise stated, n = 5 and measurements are in microns):

TOTAL LENGTH. — 4.3 (3.3-5.1) mm (n = 9).

COLORATION (pinned specimen). — flagellum light gray, with Flm_1 becoming dirty orange proximally; pedicel dirty orange; vertex dark gray, pruinose; thorax slightly orangish gray, pruinose; scutal stripes not evident; femora dirty orange proximally, becoming brown distally; tibia and tarsi light brown; abdomen dark gray-brown; haltere shaft and capitellum slightly yellowish white, base becoming light brown; hypopygium brown.

ANTENNA. — Fig. 40. 10 or 11 flagellomeres, with partial or complete fusion often occurring between 2 or 3 of $Flm_{6\text{-ultimate}}$; non-plumose, longest flagellar seta (on $Flm_{ultimate}$) 0.16 (0.14-0.17)L_{fl}; basal 0.3 of Flm_1 tapering proximally, rest roughly cylindrical, often slightly constricted at about mid-region or slightly swollen distally, without distinct basal nipple; $Flm_{2\text{-penultimate}}$ slightly fusiform, $Flm_{ultimate}$ cylindrical in basal 0.6-0.7, tapering distally to blunt apex; flagellar setae short (MaxL 66-85), setae 1-5 on Flm_1, 3-4 on $Flm_{2\,\&\,3}$, 1-2 on Flm_4, 2-5 on Flm_5, 0 or occasionally 1 on $Flm_{6\text{-penultimate}}$, 4-6 on $Flm_{ultimate}$; setae basically in single irregular whorl/flagellomere; setal whorl at 0.5-0.8 of Flm_1, near 0.5 of $Flm_{2\text{-penultimate}}$, at 0.1 of $Flm_{ultimate}$; antennal furrow absent; all Flm's with long microtrichia. Antennal sensilla as follows (n = 3): large, blunt sensillum basiconicum 1 on $Flm_{1\text{-}5}$ (that on Flm_1 distinctly smaller than succeeding ones), occasionally 1 on

[8] From *nivis* (L.), snow; *caverna* (L.), cave, grotto; and *cola* (L.), dweller, inhabitant (Brown, 1954). See "Discussion."

Flm_7; smaller, blunt sensilla basiconica (Fig. 4) 1-2 on Flm_1, 2-4 on Flm_2, 3-4 on Flm_3, 5-6 on Flm_4, 4-5 on Flm_5, 2-4 on Flm_6, 2-6 on Flm_7, 3-5 on Flm_8, 2-4 on Flm_9, 3-5 on Flm_{10}, 0-2 on Flm_{11}; long, pointed sensilla basiconica (Figs. 1-3) 0-1 on Flm_7, 2 on $Flm_{8\ \&\ 9}$, 1-2 on Flm_{10}, numerous on Flm_{11}; ringed sensilla coeloconica 1 dorsal, 1 ventral on Flm_1, 1 dorsal on Flm_2, 4-5 on Flm_{11}; small sensilla coeloconica 2 on Flm_1, 1 on $Flm_{2\ \&\ 3}$, 3-5 near apex of Flm_{11}. $\overline{L}_{flm_{1-5}} : \overline{W}_{flm_{1-5}}$ 85:35, 44:32, 43:30, 34:27, 24:28, $\overline{L}_{flm_{ultimate}} : \overline{W}_{flm_{ultimate}}$ 134:34 ($Flm_{7-penultimate}$ slightly more fusiform and smaller than Flm_{3-6}, but so often partially fused that L and W not measurable); AR 0.34 (0.28-0.39) (n = 4); 1 preapical antennal seta; L_{pas} 46 (41-49); pedicel roughly globose, with microtrichia; D_{pd} 82 (71-88); 2 (occasionally 1 or 3) pedicellar setae ventro-medially; 1 campaniform sensillum dorsally at ridge of indentation for Flm_1 (as in Fig. 41); scape quite small, with articulation to pedicel ventro-medially and to antennifer ventro-laterally; H_{sc} 72 (61-85); scape apparently with microtrichia, but without setae; dorsal region of scape weaker, less well sclerotized (Fig. 52).

HEAD. — Fig. 52. W_h 531 (454-584); coronal suture strong, ending between tops of antennal sockets and lower ends of vertex projections over scapes, bifurcating on dorsal region of vertex, with strong coronal apodeme; coronal triangle short; vertex not sunken at arms of coronal suture; coronal triangle with usual 4 short setae in large, clear sockets; rear margin of coronal triangle produced dorsad at midline to form small, clear, triangular nape; vertex medially produced toward and broadly fusing with frons, although much more weakly sclerotized between antennal sockets; vertex fairly strongly projecting over dorso-medial region of each scape; reduced ocelli very far apart, above projections over scapes; dorsal ocular apodeme absent or very weak, short; interantennal bar absent; frons weakly or not at all delimited from antennal sockets; epistomal suture moderate to weak, usually complete; interocular setae usually distinguishable from inner verticals, at about 0.4-0.6 of distance from dorso-medial margin of eye to midline of vertex; IOS/side usually 1, occasionally 0 or 3; postocular setae in uniserial or slightly staggered row running just mesad to posterior margin of eye from near postero-ventral eye margin to merge with about 4-6 slightly longer, stronger outer vertical setae; PtOS/side 4-9; inner vertical setae not well differentiated from outer verticals, the more dorsal and medial ones being more curved and slightly decumbent, reaching nearly to arms of coronal suture dorsally or to 0.71 (0.63-0.75) of distance from dorso-medial margin of eye to midline of vertex; inner verticals dispersed on dorsal region of vertex and just dorsomesad of dorso-medial margin of eye, group occurring well below dorsal margin of eye anteriorly; medial vertex setae absent; no vertex hump behind eyes. Clypeus just slightly wider than long; clypeal setae in two lateral groups; CS 8 (5-9). Tentorium (Fig. 61) not swollen antero-laterally at base, but with distinct postero-medial basal plate-like projection; tentorium usually extending slightly beyond PTP. Eyes nearly reniform; eye strongly hairy, microtrichia about twice the height of ommatidial lens; eyes with dorso-medial margin broadly truncate, dorsal corner broadly rounded; dorso-medial margin not extending as far mesad as ventro-medial margin; H_e 268 (222-293); ventral ocular apodeme absent (Fig. 61); antero-ventral margin of eye contacting tentorium; antennifer fairly well developed. Palpus 5-segmented; PS_1 without setae, subglobose, about as well sclerotized as other palpal segments; PS_{2-5} setous, basically cylindrical, PS_3 slightly swollen medially; $\overline{L}_{ps_{2-5}} : \overline{W}_{ps_{2-5}} : \overline{MaxL}_{pss_{2-5}}$

82:42:62, 139:46:56, 117:37:40, 232:33:25; sunken organ hemispherical, prominent, at 0.8 of PS_3; D_{so} 22 (18-26); all palpal segments with grouped microtrichia; CP 0.93 (0.88-1.00); palpal stoutness 3.61 (3.22-3.96). Cibarial pump higher than wide, with long, slender, pointed cornua; orifice fairly prominent. Stipes and lacinia similar to *D. mendotae*, Fig. 56.

THORAX. — L_{th} 1.22 (0.99-1.38) mm, D_{th} 1.13 (0.88-1.31) mm. All thoracic sclerites covered with fine microtrichia. Antepronotum with short, weak medial commissure which extends only about 0.4 of distance to rear margin of phragma I and is well surpassed by scutum; antepronotal notch very broad, gaping, obtuse; medial corners very broadly rounded, scarcely or not surpassing anterior margin of scutum; anterior margin of antepronotal halves arched, becoming concave antero-laterally; lateral antepronotal setae somewhat dispersed medially, region of lateral setae swollen; LAS/side 14 (9-20). Postpronotum fused completely with scutum antero-dorsally and with anteanepisternum II ventrally, delimited from scutum postero-dorsally; postpronotum without setae, but with 2 or 3 faint to clear post-pronotal sensilla(?) antero-dorsally; postpronotal apophyseal pit a small, clear oval, but postpronotal apophyses absent. Scutum in side view somewhat flattened, gently indented approximately above parapsidal suture, extending anteriorly beyond fore margin of antepronotum; scutal process absent. Dorsocentral setae ranging from completely uniserial to biserial at anterior and posterior ends of row; a few tiny, clear dots (sensilla?) present in or just beside DCS row; DCS/side 13 (9-17), $MaxL_{dcs}$ 147 (117-164); acrostichals absent. Prealar setae in staggered to fairly straight row on postero-dorsal region of prealar callus; PAS/side 6 (4-8); supraalar setae absent; scutal angle weak; parapsidal suture slightly arched, with internal apodeme; humeral scar a tuberose irregular area extending antero-dorsad from dorsal 0.3 of parapsidal suture; medial scutal scar running as a faint, narrow line from the anterior-most point of scutum to about midpoint of scutum, there expanding to form a broader, pale scar which narrows and disappears at about the ends of the dorsocentral setae rows. Scutellar setae sometimes in part in two rows, otherwise simply scattered; ScS 27 (23-32); $MaxL_{scs}$ 179 (139-209). Medial cleft of postnotum reaching about 0.5 length of postnotum; postnotum with suture on midline posteriorly and with broadly rounded postero-dorsal margin (as in Fig. 76). Anteanepisternal pit a very well-defined oval; medioanepisternum II delimited completely, ventral margin rounded; anapleural suture strong; ASR 0.52 (0.45-0.56); 0 or 1 seta on epimeral II protuberance, which is only moderately developed; no other setae on any other pleural sclerite.

WING. — L_w 3.2 (2.7-3.7) mm, W_w 1.11 (0.88-1.27) mm. Outline as in Fig. 98. Wing margin usually slightly concave at ends of R_1, M_{3+4}, and Cu_1, slightly convex just distal to anal lobe, anal lobe slightly obtuse. Dry wing showing folds about as in *D. mendotae*. Slide mounted wing showing: microtrichia visible as very numerous, close points at 150×, just barely discernible at 650× as very short seta-like projections arising from minute points or dots. Membrane without setae. Marginal setal fringe as in *D. mendotae*. Costa becoming easily discernible just before humeral cross vein, gradually increasing slightly in width distally, widest along distal 0.5 of R_1; costa ending slightly before tip of wing, about at level of end of M_{1+2}; costal projection 73 (67-79) or 2.7 (2.5-3.1) times its width; Sc appearing as sharp fold proximally, becoming very weak beyond forking of R, ending well before C. Distal 0.4-0.5 of R_1 somewhat enlarged and appressed to C, somewhat dif-

fusely fusing with C. R_{2+3} strong proximally, fading rather abruptly at about 0.4 of R_1, scarcely visible even under phase contrast beyond this; R_{2+3} running slightly closer to R_{4+5} than to R_1; very faint distal region of R_{2+3} ending quite close to tip of R_1; R_{4+5} strong, ending before level of end of M_{1+2}. r-m strong, moderately arched (more so proximally); base of r-m distal to apparent m-cu by 0.5-1 times width of r-m. M a mere trachea proximally, gradually becoming stronger towards m-cu; M_{1+2} strong proximally for just a very short distance, then fading abruptly; vestiges of ?R_5 and ?M_2 about as in *D. mendotae;* apparent m-cu little more than a trachea, approximately perpendicular to Cu and M; apparent m-cu about at apparent fCu or distal to it by less than width of apparent m-cu; VR 0.93 (0.82-0.98); M_{3+4} strong proximally for a short distance, then fading abruptly; Cu strong, with prominent trachea visible to apparent m-cu; Cu_1 just slightly and fairly uniformly arching posteriorly, or distal 0.3 curving very gently posteriorly; An quite weak, fading before wing margin. Remigium with 1 strong seta on hand, 1 or 2 weak setae and about 7-11 campaniform sensilla just beyond wrist, and 0(?)-4 setae and about 3 large and 6-8 smaller campaniform sensilla on distal 0.5 of forearm. Setae 19 (16-21) on R, 11 (8-15) on R_1, and 14-16 on R_{4+5} (uniserial and dorsal on all). Campaniform sensilla 1-2 ventrally on Sc just beyond arculus, 1 dorsally on R_1, 1 dorsally and 1 ventrally near base of R_{2+3}, and 0 on R_{4+5}. Squama with 27 (19-34) setae, $MaxL_{sqs}$ 117 (95-129); alula with 6 (4-9) short setae.

LEGS. — Legs very long, quite slender; $\bar{L}_{p_I} : \bar{L}_{tot}$ 1.71. Fe I without beard, longest seta on any femur less than width of that segment. Apical spur of Ti I fairly long, slender, with fairly numerous prickles on basal 0.5; L_{tispI} 52 (48-60); apical spurs of Ti II slightly stouter, subequal in length, with fairly numerous prickles on basal 0.5-0.6; L_{tispII} 43-71; apical spurs of Ti III with fairly numerous prickles on basal 0.5; $L_{atispIII}$ 63 (50-71), $L_{ptispIII}$ 89 (69-100); all apical tibial spurs apparently with basal oval mark (sensory dome or pit?) on basal 0.2-0.4. Weak polygon pattern not visible near apex of Ti I; polygon pattern on Ti III well developed. Ti III with posterior comb of about 18-25 spines arranged in a fairly regular single row. Apical 0.2 of posterior surface of Ti III with more numerous, slightly stronger than usual setae, but without stout spine-like setae as in species with plumose male antennae. Spiniform setae on first 3 tarsomeres of P I-III as follows: 2 (apical), 2 (apical), 2 (apical); 11-20, 4-6, 2 (apical)-3; 17-26, 7-12, 3-7. Tm_4 cordiform, about as in *D. mendotae*. Claws with about 5-7 apical teeth and with 1 strong preapical tooth along outer margin (Fig. 25); 3-5 long, slender spines arising from

	Fe	Ti	Tm_1	$Tm_{2\text{-}5}$	LR	BV	SV
P_I	2120 (1650–2500)	2230 (1710–2600)	1450 (1110–1710)	1380 (1110–1650)	0.65 (0.63–0.67)	4.19 (4.03–4.34)	3.00 (2.89–3.08)
P_{II}	2260 (1720–2670)	2040 (1600–2400)	1110 (860–1310)	1160 (920–1340)	0.54–0.55	4.67 (4.52–4.79)	3.88 (3.87–3.93)
P_{III}	2240 (1760–2640)	2330 (1790–2690)	1590 (1230–1860)	1550 (1240–1760)	0.68 (0.67–0.69)	3.97 (3.84–4.07)	2.88 (2.84–2.91)

base of claws. Empodium long, curving up between claws, with numerous long, slender curved spines; minute spinous pulvilli apparently present near base of claws. Lengths and ratios of leg segments, p. 126.

HYPOPYGIUM. — Fig. 136. Tg IX with 0-4 setae/side. Anal point slender distally, becoming very broad basally, with about 4-8 setae/side on broad basal region and with small apical peg; apodemes on underside of Tg IX forming very obtuse V, ending in antero-lateral corners of Tg IX; L_{gncx} 277 (239-300), $\bar{L}_{tot}$:$\bar{L}_{gncx}$ 16. Gonocoxite broad. Basal plate fairly well developed, with very coarse microtrichia ventrally, and with disto-medial margin slightly obtuse. Medial field weakly developed. Gonocoxite with very strong dorso-medial corner or ridge. Gonostylus expanded distally, with flat, microtrichia-covered area dorso-distally; gonostylus apparently without subterminal peg; gonostylus not capable of folding forward. Sternapodeme produced to a point antero-medially. Basal wedge short, slender, but well sclerotized.

DIAGNOSIS. — Antenna with 10-11 flagellomeres, gonostylus not folding forward and with flat, distal, microtrichia-covered region. There are no other known species with these features.

MATERIAL EXAMINED. — [*Alaska*], Valdez Alsk, 5 mi NW 24 VIII, 48 BLMorris, Alaska Ins project, 1 male (USNM); *Washington*, 3 mi E, 6 mi S of Glacier, in cavern in snow field above timberline on Mt. Baker, 7, 8 Sept. 1967, leg. D. Hansen, about 100 males and females (UMn).

DISCUSSION. — I was once collecting in a small melt-water stream above timber-line on Mt. Baker, and I followed the stream to where it emerged from a small cavern it had cut in a snowfield. The snowfield was about two meters deep, and the cavern cut in it was about one to two meters wide and one meter high and extended back into the snowfield for many meters. Out of curiosity I looked into the cavern and was amazed to see that there were scores of adult *D. nivicavernicola* and, interestingly, also many mycetophilids walking on the roof of the cavern. The presence of numerous mycetophilids implies to me that the cavern was probably a sort of natural Malaise trap, and that both the *Diamesa* and the mycetophilids came into it to find shelter or a hiding place. The name *nivicavernicola* indicates this unusual collecting site, i.e., it means "snow cave dweller."

D. nivicavernicola has a number of noteworthy morphological features. It is the only reported species with 10 or 11 flagellomeres in the antenna, and it is the only species I know of with setae on the alula. The legs, furthermore, are extraordinarily long, that is, the fore leg is some 1.71 times the body length (the value in species with plumose antennae is generally 1.0-1.1). The gonostylus is unusual because it extends rearward and does not fold anteriorly as is the usual case in orthoclads. The gonostylus also lacks a subterminal peg.

LOCATION OF TYPE. — The holotype is a specimen collected by me on Mt. Baker (see "material examined"); it is deposited in the entomology collection of the Department of Entomology, University of Minnesota, St. Paul, Minnesota. All other specimens examined are designated as paratypes and are deposited in the UMn, USNM, CNC, and ANSP.

Diamesa nivoriunda (Fitch)

Chironomus nivoriundus Fitch, 1847: 282-283 (described from male and female adults from New York).

D. nivoriunda (Fitch). Johannsen, 1903: 439-441, pl. 47, 48 (as synonym of "*D. waltlii* Meig. (= *aberrata* Lundb.)"; description of adult, pupa, and larva); Johannsen, 1934: 348 (discussion of correct generic placement of "*nivoriundus*" Fitch); Johannsen, 1937: 34-35 (further description of larva and pupa); Johannsen, 1952: 13 (as senior synonym of *Eutanypus borealis* Coq. and *Tanypus heteropus* Coq.); Paine and Gaufin, 1956: 295 (some ecological requirements of larva); Roback, 1957b: 51-53 (larva and pupa in key; records from Pennsylvania); Curry, 1965: 137 (some ecological requirements of larva, from Paine and Gaufin (1956)).

[*non*] *D. nivoriunda* (Fitch). Sublette, 1964: 130, 132 (misdetermination of a western species with hairy eyes); Cole, 1969: 99 (probable misdetermination of an Oregon species).

Description (unless otherwise stated, n = 5 and measurements are in microns): as in *D. mendotae* except:

TOTAL LENGTH. — 5.3 (4.9-5.7) mm.

COLORATION (pinned specimens). — about as in *D. mendotae*.

ANTENNA. — longest flagellar setae 0.68 (0.67-0.70)L_{fl}; Flm_{13} with apical 0.20-0.23 spindle-shaped, mainly swollen ventrally; 2 short, slender setae dorso- and ventro-medially on Flm_1; long (MaxL 883-924) setae 1 on Flm_1, 4 on Flm_2, about 8-11 on Flm_3, increasing to about 14-15 on Flm_{12}, numerous on Flm_{13}; setae usually on basal 0.1-0.3 of spindle-shaped region of Flm_{13}; $\overline{L}_{flm_{1-13}}:\overline{W}_{flm_{1-13}}$ 97:61, 21:54, 24:52, 27:48, 25:47, 25:46, 25:47, 28:46, 32:45, 34:44, 35:43, 37:41, 848:40; AR 1.78 (1.72-1.81); 1 preapical antennal seta, L_{pas} 43 (38-46); D_{pd} 186 (184-188); 1(?)-3 (usually 2) pedicellar setae ventro-medially; H_{sc} 203 (192-208).

HEAD. — W_h 733 (712-753); dorsal ocular apodeme weak to moderate; epistomal suture fairly weak medially, weak or nearly absent laterally; IOS/side 3-5, rarely not well separated from inner verticals; inner verticals reaching to 0.43-0.67 of distance from dorso-medial margin of eye to midline of vertex. Clypeus usually slightly wider than long; CS 14 (11-19). Dorso-medial margin of eye extending not quite as far or as far mesad as ventromedial margin; H_e 330 (327-335); $\overline{L}_{ps_{2-5}}:\overline{W}_{ps_{2-5}}:\overline{MaxL}_{pss_{2-5}}$ 105:48:113, 166:57:91, 159:44:60, 243:35:34; D_{so} 21 (16-26); CP 1.08 (1.01-1.14); palpal stoutness 3.70 (3.41-3.85).

THORAX. — L_{th} 1.48 (1.30-1.60), D_{th} 1.34 (1.21-1.46) mm. Antepronotum with medial commissure strong, not quite reaching rear margin of phragma I, reaching to or slightly surpassing anterior margin of scutal process; antepronotal notch acute,

medial corners fairly sharp, well surpassing scutal process; LAS/side 9-11; postpronotal apophyses rather weak; dorsocentrals uniserial to slightly staggered posteriorly; DCS/side 8 (6-11), $MaxL_{dcs}$ 196 (172-208); PAS/side 8-10; ScS about 30, $MaxL_{scs}$ 198-222; ASR 0.65 (0.63-0.70); 0-1 seta on epimeral II protuberance.

WING. — L_w 3.7 (3.6-3.8) mm, W_w 1.19 (1.12-1.26) mm. Costal projection 104 (85-134) or 5.0 (4.4-5.5) times its width; apparent m-cu distal to apparent fCu by about 1-4 times width of apparent m-cu. VR 0.94 (0.93-0.95). Remigium (n = 3) with 1 strong seta on hand, 1-2 weak setae and about 9 campaniform sensilla just beyond wrist, and 1-3 setae and 4 large and about 9 smaller campaniform sensilla on distal 0.5 of forearm. Setae 16-17 on R, 8-10 on R_1, and 6 (3-8) on R_{4+5} (uniserial and dorsal on all). Campaniform sensilla 3 ventrally on Sc just beyond arculus, 2 dorsally on R_1, 1 (occasionally 2) dorsally and 1 ventrally near base of R_{2+3}, and 2-4 dorsally on R_{4+5}. Squama (n = 2) with 34-43 strong setae, $MaxL_{sqs}$ 156-173.

LEGS. — $\overline{L}_{p_I}:\overline{L}_{tot}$ 1.07; Fe I with sparse postero-dorsal beard of about 8-12 long setae. Apical spur of Ti I long, slender, with rather sparse prickles on basal 0.2-0.3; apical spurs otherwise essentially as in *D. mendotae*. Weak polygon pattern occasionally visible near apex of Ti I. Ti III with posterior comb of about 18-23 spines arranged in a fairly regular to slightly staggered single row. Spiniform setae on first 3 tarsomeres of P I-III as follows: 7-11, 2 (apical)-4, 0; 10-13, 5-7, 0-2 (1 at 0.5 or 1 apical and 1 at 0.5); 15-18, 6-8, 1-3. Lengths and ratios of leg segments as follows:

	Fe	Ti	Tm_1	Tm_{2-5}	LR	BV	SV
P_I	1550 (1410-1630)	1770 (1560-1860)	1170 (1040-1260)	1200 (1130-1240)	0.66 (0.64-0.68)	3.73 (3.57-3.81)	2.84 (2.69-3.00)
P_{II}	1680 (1550-1760)	1610 (1450-1690)	700 (640-740)	880 (840-910)	0.44 (0.42-0.44)	4.52 (4.32-4.70)	4.68 (4.47-4.89)
P_{III}	1870 (1760-1960)	1940 (1760-2030)	1220 (1140-1310)	1270 (1230-1340)	0.63 (0.58-0.66)	3.98 (3.80-4.17)	3.13 (2.94-3.34)

HYPOPYGIUM (without reference to *D. mendotae*). — Fig. 129. Tg IX with 13 (8-19) setae/side. Anal point strong, broadening just slightly basally, often with slight distal keel, apparently without or with only small apical peg; strong apodemes on underside of Tg IX diverging, arching to antero-lateral corners of Tg IX; L_{gncx} 360 (332-374); $\overline{L}_{tot}:\overline{L}_{gncx}$ 15. Basal plate very well developed, with numerous strong microtrichia and a few setae ventrally, with disto-medial corner rounded, projecting. Medial field about as in *D. mendotae*. Basimedial setal cluster with numerous very long, strong setae radiating slightly, setae reaching base of opposite cluster. Gonostylus approximately triangular, with subterminal peg and short terminal ridge. Sternapodeme fairly narrow medially, with antero-lateral projections; anterior margin straight to moderately concave medially. Basal wedge very strong, rugose, extending nearly to distal end of basal plate.

DIAGNOSIS. — Antenna plumose, eyes hairy, basal plate produced disto-medially, basimedial setal cluster strong, gonostylus triangular. The gonostylus is distinctively shaped.

MATERIAL EXAMINED. — [*Alabama*, presumably], Ala., Florence, 20-26 XII 1954, W. E. Snow, 55-7337-6, 1 male (USNM); *Indiana*, Warren Co., 2 mi. SE Greenhill, Small Pine Creek, leg. G. R. Finni, 18-I-1969, 1 male, 1 female (IllNatHstSur); *Massachusetts*, Amherst, 29-IV-39, M. E. Smith, 1 male (JES); *Maryland*, Forest Glen, Montgomery County, 19 April 1968, leg. W. W. Wirth, light trap, 2 males (USNM); Hagerstown, IV.17.18, 1 male (USNM); *Michigan*, East Lansing, 22 Mar. 1936, C. Sabrosky, slide 41.IV.5a, 1 male (USNM); Hunt Creek, Montmorency County, XII-22-1942, J. W. Leonard, 2 males (USNM); Montmorency Co., along Hunt Creek, Sec. C, on snow, 22 Dec. 1942, L. H. Bush, L42-176, 3 males (UMich); *Minnesota*, Cook Co., Forest Service Station at Hovland, N. J. mosquito trap, 21 April, 19, 30 Sept., 13-19 Oct. 1968, 28 Sept., 14 Oct. 1969, 19 males, 9 females (UMn); Cook Co., 2 mi. N of Hovland on US 61, N. J. mosquito trap, 30 April 1970, leg. E. F. Cook, 1 male (UMn); Duluth, on snow by Amity Creek, air about 34°F, cloudy, 27 March 1971, leg. D. Hansen, 5 males (UMn); Duluth, outlet to Heartly Pond, 23 Feb. 1971, about 10 males, 10 females, 20 pupal exuviae (UMn); Duluth, on snow by Lester River, 1 Jan., 15, 16, 25 Feb. 1971, leg. D. Hansen, numerous males, females, pupal exuviae (UMn); Olmsted County, 2/22, C. N. Ainslie, 6 males (UMn); 4 mi. S. of Cannon Falls, on snow by small stream, about 2 PM, 7 Feb. 1970, leg. D. Hansen, numerous males, females, pupal exuviae (UMn); *Missouri*, in stream 1.5 miles S. of Cabool, water 16°C, 12 Apr. 1969, leg. D. Hansen, 1 male pupa, numerous larvae (UNm); *Newfoundland*, Torbay, R. F. Morris, 14-IV-1966, 1 male (IllNatHstSur); *New York*, Ithaca, no dates (3 males) or various dates, Dec. to May, leg. O. A. Johannson, R. G. Beard, or H. K. Townes, about 14 males (Cornell, Townes); Ithaca, 100 yds. S. of Water St., Six-Mile, 21, 28.I.1968, E. L. Rittershausen, collector, 6 males (Cornell); Ithaca, 11 May '02, gynandromorph (female flagellum with 8 flagellomeres, normal male hypopygium) (Cornell); Ithaca, Buttermilk, 29-XII-1966, R. G. Beard, mating pair, 1 male (Cornell); Ludlowville, 24 Dec. 1965, leg. L. L. Pechuman, 1 male (Cornell); Myers, Salmon Creek Bridge, Dec. 1966, Jan. 1967, leg. L. L. Pechuman, 18 males (Cornell); *Ontario*, Ancaster, 1 Jan. 1967, J E H Martin, 5 males (CNC); Loon Lake nr. Essonville, 15-III-1965, Martin and McAlpine, 1 male (CNC); *Quebec*, Gatineau Park, 22 March 1964, leg. D. R. Oliver, No. Q 15-3, 1 male (CNC); *Virginia*, Falls Church, Holmes Run, 23 IV 1962, leg W W Wirth, light trap, 2 males (USNM); *Wisconsin*, Univ. Wis. Arboretum, III-21-1953, coll. F. E. Strong, 1 male (UCalDav); 45°43'N, 92°09'W, 11 mi E, 4 mi S of Siren, Burnett County, light trap by small, cold stream (Spring Brook), 8 Oct., 2 Nov. 1966, leg. D. Hansen, 2 males (UMn); Sauk Co., Otter Cr., 18-I, 8, 15-II-1969, coll. Richard Narf, 5 males (UMn).

DISCUSSION. — Fitch (1847) proposed the name *Chironomus nivoriundus* ("the snow-born midge") for a common winter midge he found in New York State. The description could apply either to a *Diamesa* or a few other orthoclads; indeed, judging from Fitch's discussion of the species, Fitch possibly was seeing two or more species and calling them all *C.*

nivoriundus. He made no mention of the shape of the fourth tarsomere or of the presence or absence of the apparent m-cu cross-vein, so the description really doesn't permit even a definite generic placement. Johannsen (1903) reared a species which he called *D. Waltlii,* and he regarded *C. nivoriundus* Fitch as a synonym of *D. Waltlii.* Johannsen quite clearly illustrated the hypopygium of "*Waltlii.*" Johannsen (1934) later stated that *Waltlii* was not the same as *nivoriunda* (Fitch), and he further stated that *nivoriunda* belonged in *Diamesa* and not *Orthocladius,* where he (Johannsen, 1905) had once placed it.

Sublette (1964) and Cole (1969) were probably seeing *heteropus,* the common western hairy-eyed Diamesa.

D. nivoriunda is the most common northeastern species of *Diamesa.* It is sometimes taken with *cheimatophila* in the Northeast and with *mendotae* in the Midwest. The emergence period is from September to May.

Location of types. — I have not tried to locate Fitch's material, although it is possibly at the New York State Museum in Albany.

Diamesa simplex Kieffer

D. simplex Kieffer, 1926: 80, 81 (described from 1 male taken on the Second Fram-Expedition to North America, "Havnen, 3.9.99, Schei."; figures part of gonocoxite, gonostylus); Oliver, 1959: 63 (features of hypopygium of holotype; as probable synonym to *D. aberrata* Lundbeck); Oliver, 1962: 4 (in discussion under *D. aberrata* Lundbeck; regards as distinct species; discussion of differences between *simplex* and *aberrata*).

D. aberrata Lundbeck. Edwards, 1935: 471 (in part) (misdetermination of 2 of 4 specimens); Andersen, 1937: 80-82 (misdetermination; description of larva, pupa, adult; figures of various parts).

Description (unless otherwise stated, n = 5 and measurements are in microns): as in *D. mendotae* except:

Total length. — 4.3 (3.9-4.8) mm (n = 4).

Coloration. — not noted before slide mounting.

Antenna. — longest flagellar setae 0.53 (0.50-0.58)L_{fl}; Flm_{13} with apical 0.20-0.25 spindle-shaped, mainly swollen ventrally; 1-2 short, slender setae dorso- and ventro-medially on Flm_1; long (MaxL 560-830) flagellar setae 0-1 on Flm_1, 2-4 on Flm_2, 7-9 on Flm_3, increasing to about 14 on Flm_{12}, numerous on Flm_{13}; $\bar{L}_{flm_{1-13}} : \bar{W}_{flm_{1-13}}$ 91:50, 20:46, 23:46, 27:41, 29:40, 30:40, 34:40, 36:40, 39:41, 41:40, 43:40, 44:39, 690:37, AR 1.35 (1.14-1.66); 1 preapical antennal seta; L_{pas} 34 (30-40); D_{pd} 177 (156-212); 2 pedicellar setae ventro-medially; H_{sc} 175 (158-212).

Head. — W_h 612 (543-707); dorsal ocular apodeme absent to strong; IOS/side 2-4; PtOS/side 10-12; inner verticals reaching to 0.56-0.67 of distance from dorsomedial margin of eye to midline of vertex. Clypeus slightly swollen anteriorly, about as wide as long; CS 9 (6-12). Eyes not hairy, microtrichia not visible laterally, appearing as minute spines antero-medially; dorso-medial margin of eye extending not

quite as far or about as far mesad as ventro-medial margin; H_e 266 (241-303). $L_{ps_{2\text{-}5}}$: $W_{ps_{2\text{-}5}}$: $MaxL_{pss_{2\text{-}5}}$ 93:36:92, 156:40:76, 145:35:67, 204:30:31; D_{so} 14 (12-18); CP 1.02 (0.91-1.18); palpal stoutness 4.34 (3.44-5.08).

THORAX. — L_{th} 1.04 (0.90-1.21) mm (n = 4), D_{th} 1.08 (0.95-1.26) mm (n = 4). Antepronotum with medial commissure strong, but not reaching to rear margin of phragma I, reaching to but not surpassing anterior margin of scutal process; antepronotal notch ranging from weak, with medial corners rounded and scarcely surpassing scutal process, to weak but acute, with more sharply rounded medial corners; LAS/side 7 (5-10); postpronotum without setae and with 0-2 small, indistinct sensilla (?) on antero-dorsal border; dorsocentrals uniserial; DCS/side 9 (6-11), $MaxL_{dcs}$ 165 (145-212) (n = 4); PAS/side 6 (4-9); humeral scar a weak, roughened, irregular area just anterior to dorsal 0.2 of parapsidal suture; scutellar setae in 1 or 2 irregular rows; ScS about 13 (8-about 20), $MaxL_{scs}$ 137 (119-158); ASR 0.63 (0.62-0.66); 0-about 6 setae on epimeral II protuberance; 1 specimen with 2 small setae on preepisternum II just below anapleural suture.

WING. — L_w 3.2 (2.6-4.2) mm, W_w 1.01 (0.88-1.28) mm. Costal projection 87 (59-129) or 4.8 (3.8-5.9) times its width; apparent m-cu distal to apparent fCu by 2-4 times width of apparent m-cu; VR 0.92 (0.90-0.95). Remigium with 1 strong seta on hand, 0(?)-1 weak seta and about 13-18 campaniform sensilla just beyond wrist, and 2 setae and 4-5 large and about 8-10 smaller campaniform sensilla on distal 0.5 of forearm. Setae 14 (8-19) on R, 11 (9-15) on R_1, and 3 (2-5) on R_{4+5} (uniserial and dorsal on all). Campaniform sensilla 3 ventrally on Sc just beyond arculus, 2-3 dorsally on R_1, 1 dorsally and 0-1 ventrally near base of R_{2+3}, and 2-3 dorsally on R_{4+5}. Squama with 24-45 (n = 4) strong setae, $MaxL_{sqs}$ 108-190 (n = 3).

LEGS. — $\bar{L}_{p_I}$: $\bar{L}_{tot}$ 1.17; Fe I with very sparse postero-dorsal beard of only 2-4 long setae. Apical spur of Ti I long, slender, with sparse prickles on basal 0.2-0.4; $L_{atispIII}$ 45-60, $L_{ptispIII}$ 60-93; apical tibial spurs otherwise essentially as in *D. mendotae*. Weak polygon pattern occasionally barely visible near apex of Ti I. Ti III with posterior comb of about 15-18 spines arranged in a fairly regular single row. Spiniform setae on first 3 tarsomeres of P I-III as follows: 2 (apical)-3, 2 (apical), 0-2 (apical); 9-15, 2 (apical)-4, 0-2 (apical); 8-14, 3-8, 2 (apical)-3. Lengths and ratios of leg segments as follows:

	Fe	Ti	Tm_1	$Tm_{2\text{-}5}$	LR	BV	SV
P_I	1300 (1075–1630)	1500 (1210–1860)	1080 (840–1310)	1140 (960–1430)	0.72 (0.69–0.75)	3.34 (3.23–3.52)	2.60 (2.49–2.72)
P_{II}	1460 (1175–1860)	1430 (1175–1725)	750 (600–940)	900 (710–1140)	0.53 (0.50–0.55)	4.04 (3.90–4.16)	3.85 (3.72–4.00)
P_{III}	1660 (1330–2100)	1740 (1390–2160)	1180 (960–1430)	1180 (990–1450)	0.68 (0.65–0.70)	3.87 (3.71–4.06)	2.86 (2.72–3.00)

HYPOPYGIUM (without reference to *D. mendotae*). — Fig. 111. Tg IX with 12-18 setae/side; anal point moderate, about as long as Tg IX, either without apical peg or with apical peg in deep depression; apodemes on underside of Tg IX absent or only weak, forming a "T". L_{gncx} 273 (243-309); L_{tot}:L_{gncx} 16. Basal plate scarcely developed, with microtrichia ventrally. Medial field only very weakly developed, without well-delimited dorsal border, with numerous microtrichia and setae; distal end of medial field not free. Gonostylus broad in apical 0.6, narrowing fairly sharply proximally. Sternapodeme a fairly simple arch slightly broadening medially. Basal wedge short but well developed, rugose laterally.

DIAGNOSIS. — Antenna plumose, eyes not hairy; anal point present; medial field only weakly developed; gonostylus abruptly narrowed proximally. *D. aberrata* is similar but has a shorter anal point and a more slender gonostylus.

MATERIAL EXAMINED. — *Alaska,* various localities around Anchorage, July 1964, Sept. 1964, 1966, 6 males (USNM); various localities on Kenai Peninsula, June, July, August 1965, leg. K. M. Sommerman, jeep trap, about 70 males (USNM); Old Matanuska to Eklutna, 22 June 1964, jeep trap, 11:00-12:10 AM, 64-15, KMS, 1 male (USNM); Palmer, 23.IX.1964, K. M. Sommerman, jeep trap, 1 male (USNM); [*British Columbia,* presumably], U. B. C., 18.3.39, A. MG., 6, 1 male (UBC); *East Greenland,* Jameson Land, 4-14.viii.1933, D. Lack, B. M. 1933-233 [det. as *D. aberrata*], 2 males (BMNH); *Greenland,* Etah, August 16, '08, Peary's North Pole Exp. 1908, 1 male (USNM); [*Greenland*], Can. Nat. Collection, Nedre Midsommer So Greenland, coll: 3.VII.1966, Can. Peary Land Expd., from GP.30.185, 1 male with larval and pupal exuviae (CNC); [*North West Territories*], Clyde River, Baffin Island, 15-IX-1935, W. J. Brown, 2 males (CNC); ND.16.3 Devon Is, 5.IX.60, Devon Is. Expd., coll. D. R. Oliver, 9 males (CNC); Ellesmer [sic] Land, Ward Hunt I., 20 June 1960, Spokas, coll, #3 *Diamesa simplex* Kieffer ♂ [det. ?], 1 male (USNM); Hazen Camp, NE.210, NE.228, NE.232, Ellesmere I., 10, 13.VIII.1961, D. R. Oliver, *Diamesa simplex* Kief. det 1962, D. R. Oliver, 22 pupae (CNC); Truelove R., Devon I., N. W. T., 5 Sept. 1960, coll. D. R. Oliver, *Diamesa,* det. D. R. Oliver, ND.16, 1 male (CNC); ND.17-7, Truelove R., Devon Is., 5.IX.60, Devon Is. Exp., coll. D. R. Oliver, 3 males (CNC); ND.17, Truelove R., Devon Is., 5.IX.60, D. R. Oliver, numerous pupae (CNC); [*Quebec*], Gt. Whale R., P. Q. 9.IX.1949, J. R. Vockeroth, 1 male (CNC); *Wyoming,* 44°10'N, 107°05'W, Powder River Pass, 18 mi W, 13 mi S of Buffalo, alt. 9,600', sweeping in spruce-fir forest, 26, 27 Aug. 1967, leg. D. Hansen, 2 males (UMn).

DISCUSSION. — Kieffer (1926) described *simplex* from a single male from the Zoological Museum of Oslo. The specimen had been collected by Per Schei, the geologist and palaeontologist on the Second Norwegian Arctic Expedition in the "Fram," at "Havnen." Havnen is Havnefjord or Harbour Fjord on the southern coast of Ellesmere Island. Fortunately, Kieffer did illustrate the gonostylus. Oliver (1959) examined the holotype at Oslo and found that the hypopygium was badly damaged. At that

time he had not seen *aberrata* and felt that Andersen (1937) was probably correct in synonymizing *simplex* with *aberrata.* Oliver (1962) later examined Lundbeck's series of *aberrata,* however, and established that *simplex* is a distinct species.

D. simplex has previously been recorded from Ellesmere Island (Kieffer, 1926), Jameson Land, East Greenland (Edwards, 1935, misdetermined as *aberrata*), and north east Greenland (Andersen, 1937, misdetermined as *aberrata*). I have seen additional arctic specimens from Etah and south Greenland and Baffin, Devon, and Ellesmere Islands. Interestingly, however, the species also extends into Alaska and down the Rocky Mountains into British Columbia and Wyoming. It must also have one of the most far northern records of any insect: one specimen is from Ward Hunt Island. Only Peary Land in Greenland extends farther north.

Location of type. — Holotype at the Zoological Museum of Oslo (Oliver, 1959).

Diamesa sommermani new species

Description (unless otherwise stated, n = 1 and measurements are in microns): as in *D. mendotae* except:

Total length. — not noted before slide mounting.

Coloration. — not noted before slide mounting.

Antenna. — longest flagellar seta $0.64L_{fl}$; Flm_{13} with apical 0.23 spindle-shaped, mainly swollen ventrally; 2 short, slender setae dorso- and ventro-medially on Flm_1; long (MaxL 859) flagellar setae 1 on Flm_1, 3 on Flm_2, 6 on Flm_3, about 10 on Flm_4, increasing to 14 on Flm_{12}, numerous on Flm_{13}; setae on basal 0.1 of spindle-shaped region of Flm_{13}; small, blunt sensilla basiconica 2 ventrally on Flm_1, 1 on $Flm_{2\,\&\,3}$; spindle-shaped region of Flm_{13} with sensilla as in *D. mendotae* except with only 1 blunt sensillum basiconicum arising from distinct pit; $L_{flm_{1\text{-}13}}:W_{flm_{1\text{-}13}}$ 105:56, 22:49, 27:51, 27:46, 32:46, 32:46, 32:46, 34:46, 39:46, 39:44, 44:41, 49:44, 788:41; AR 1.45; 1 preapical antennal seta; L_{pas} 40; D_{pd} 190; 4-5 pedicellar setae ventromedially (n = 2); H_{sc} 208.

Head. — W_h 720; dorsal ocular apodeme moderate; epistomal suture strong to weak medially, weak to nearly absent laterally (n = 5); IOS/side 6, 7; PtOS/side 14-16; inner verticals reaching to 0.60 of distance from dorso-medial margin of eye to midline of vertex. Clypeus slightly swollen anteriorly, about as wide as long; CS 17. Eyes not hairy, microtrichia visible as minute points antero-medially, not visible laterally; dorso-medial margin extending not quite as far mesad as ventro-medial margin; H_e 326. $L_{ps_{2\text{-}5}}:W_{ps_{2\text{-}5}}:MaxL_{pss_{2\text{-}5}}$ 127:46:90, 183:54:90, 190:44:78, 244:37:54; D_{so} 20; CP 0.96; palpal stoutness 4.13.

Thorax. — L_{th} 1.52 (1.43-1.65) mm, D_{th} 1.47 (1.38-1.56) mm (n = 6). Antepronotum with medial commissure strong, not reaching rear margin of phragma I, slightly surpassing anterior margin of scutal process; antepronotal notch slightly obtuse, with medial corners rounded and well surpassing scutal process; LAS/side about 6. Postpronotum without setae, and with sensilla not visible on antero-dorsal border

in slides available. Dorsocentrals uniserial; DCS/side 12-16, $MaxL_{dcs}$ about 170 (n = 2); PAS/side about 9; ScS about 48, $MaxL_{scs}$ 200-250 (n = 2); ASR 0.63; 3 setae on epimeral II protuberance.

WING. — L_w 3.5 (3.1-3.8) mm, W_w 1.23 (1.11-1.38) mm. Dry wing not available. Slide mounted wing showing: costal projection 96 (68-122) or 4.4 (3.0-5.6) times its width; R_1 slightly to moderately (i.e., distal 0.2 slightly less than 2 times as wide as proximal 0.2) enlarged distally; apparent m-cu distal to apparent fCu by about 1-4 times width of apparent m-cu; VR 0.91 (0.86-0.93). Remigium with 2 strong setae on hand (n = 1), 0(?) setae and about 18 campaniform sensilla just beyond wrist (n = 1), and 2-4 setae and 4 large and about 9 smaller campaniform sensilla on distal 0.5 of forearm. Setae 17 (13-20) on R, 12 (9-15) on R_1, and 7 (2-11) on R_{4+5} (uniserial and dorsal on all). Campaniform sensilla 3 ventrally on Sc just beyond arculus, 2-3 dorsally on R_1, 1 dorsally and 1 ventrally near base of R_{2+3}, and 2-5 dorsally on R_{4+5}. Squama with 68-82 (n = 2) strong setae, $MaxL_{sqs}$ 183-203 (n = 3).

LEGS. — $L_{p_I}:L_{tqt}$ not measurable on slides available. Fe I with sparse postero-dorsal beard of about 10 long setae. L_{tispI} 102; apical spurs otherwise essentially as in *D. mendotae*. Weak polygon pattern barely visible near apex of Ti I; polygon pattern on Ti III moderately developed. Spiniform setae on first 3 tarsomeres of P I-III as follows: 4, 2, 0; 15, 3, 0; 22, 6, 1 (at about 0.6). Lengths and ratios of leg segments as follows:

	Fe	Ti	Tm_1	Tm_{2-5}	LR	BV	SV
P_I	1562	1825	1336	1378	0.73	3.43	2.54
P_{II}	1758	1690	857	1008	0.51	4.27	4.02
P_{III}	1994	2063	1344	1327	0.65	4.07	3.02

HYPOPYGIUM (without reference to *D. mendotae*). — Fig. 135. Tg IX with 17, 18 setae/side. Anal point strong, slender distally, broadening slightly basally, with short terminal peg set in small depression; strong apodemes on underside of Tg IX diverging from base of anal point and arching to antero-lateral corners of Tg IX; L_{gncx} 384. Basal plate weakly developed, with microtrichia ventrally. Medial field well developed, but obscured in dorsal view by very strong postero-dorsal projection of gonocoxite. Gonostylus fairly long, slender, about of equal width throughout, with subterminal peg and very short terminal ridge. Sternapodeme quite broad medially, without antero-lateral projections; fore margin roughly straight medially. Basal wedge fairly short but strong, rugose.

DIAGNOSIS. — The large thumb-like projection of the gonocoxite is unique among described *Diamesa.*

MATERIAL EXAMINED. — *Alaska,* Anchorage-Granite Creek, 8 Sept. 1966, K. M. Sommerman, jeep trap 66-47, 2 males (USNM); Anchorage-Seward Hwy., 25 Aug. 1964, K. Sommerman, jeep trap, 1 male (USNM); Kenai Pen., Johnson L.-Soldatna, 19 June 1965, K. M. Sommerman, jeep trap, 2 males (USNM); Kenai Pen., 17 June 1965, jeep trap 65-2, 9:10-10:50 PM, Primrose-Seward and back, K. M. Sommer-

man, 1 male (holotype) (USNM); Kenai Pen., Seward-Primrose CG, 17 June 1965, K. M. Sommerman, jeep trap, 1 male (USNM); Kenai Pen., Wildwood-Soldatna, 18 June 1965, K. M. Sommerman, jeep trap, 1 male (USNM); Matanuska, Eklutna Hwy., 22 June 1964, K. M. Sommerman, jeep trap, 1 male (USNM); Palmer, 23 Sept. 1964, K. Sommerman, jeep trap, 1 male, (USNM); Seward Hwy., Mud L.-Kenai L.-Summit L., 20 IX 1965, K. M. Sommerman, jeep trap 65-22, 2 males (USNM); Seward Hwy., Mud L.-Summit L. Lodge, 2 Sept. 1965, K. M. Sommerman, jeep trap 65-20, 4 males (USNM).

DISCUSSION. — *D. sommermani* is described from material collected in Alaska. The species is distinctive with its large postero-dorsal projection on the gonocoxite. *D. sommermani* is named in honor of Dr. Kathryn M. Sommerman, who collected long series of several species of *Diamesa* on various trips in Alaska with her "jeep trap." Without this material my study would have had very few representatives from Alaska, and I am very grateful to Dr. Sommerman for her collecting efforts.

LOCATION OF TYPE. — Holotype is a slide-mounted male collected: USA, Alaska, Kenai Pen[insula], June 17, 1965, Jeep trap 65-2, 9:10-10:50 PM. Primrose-Seward and back, [leg.] K. M. Sommerman; it is deposited in the USNM. The other specimens examined are designated as paratypes and are deposited in the USNM and UMn.

Diamesa spinacies Saether

D. spinacies Saether, 1969: 27-33 (described from 1 male reared from a pupa, female pupa with larval exuviae, larvae, from Alberta).

D. arctica (Boheman). Young, 1969: 1204 (misdetermination by D. Hansen).

Description (unless otherwise stated, n = 5 and measurements are in microns): as in *D. mendotae* except:

TOTAL LENGTH. — 5.5 (4.9-6.3) mm.

COLORATION (pinned specimen). — as in *D. mendotae* except: haltere with capitellum and distal 0.4 of shaft pale; base light brown.

ANTENNA. — longest flagellar seta 0.60 (0.54-0.66)L_{fl}; Flm_{13} with apical 0.16-0.26 spindle-shaped, mainly swollen ventrally; 2-4 short, slender setae dorso- and ventro-medially on Flm_1; long (MaxL 717-952) flagellar setae 1 on Flm_1, 3-4 on Flm_2, 5-9 on Flm_3, increasing to 13-16 on Flm_{12}, numerous on Flm_{13}; $\overline{L}_{flm_{1-13}}$: $\overline{W}_{flm_{1-13}}$ 104:59, 22:49, 26:49, 29:49, 28:47, 29:46, 31:44, 31:43, 36:43, 37:41, 39:40, 42:40, 899:39; AR 1.72 (1.58-1.96); 1 preapical antennal seta; L_{pas} 42 (29-51); D_{pd} 197 (181-210); 2-4 pedicellar setae ventro-medially; H_{sc} 211 (193-224).

HEAD. — W_h 698 (655-737); dorsal ocular apodeme weak to strong; IOS/side 5 (3-6); a pair of medial vertex setae rarely present (Fig. 51); PtOS/side 12-18; outer verticals 6-9; inner verticals reaching to 0.53-0.67 of distance from dorso-medial margin of eye to midline of vertex; clypeus slightly swollen anteriorly, about as long as wide; CS 17 (12-24). Eyes not hairy, microtrichia not visible laterally, visible as tiny spines between ommatidia antero-medially; H_e 318 (298-341). $\overline{L}_{ps_{2-5}}$: $\overline{W}_{ps_{2-5}}$:

$\overline{MaxL}_{pss_{2\text{-}5}}$ 123:43:109, 174:50:109, 175:40:97, 250:33:41; D_{so} 16 (14-18); CP 0.96 (0.88-1.00); palpal stoutness 4.45 (3.87-4.79).

THORAX. — L_{th} 1.52 (1.38-1.67) mm, D_{th} 1.44 (1.31-1.55) mm. Antepronotal notch right-angled or slightly obtuse, medial corners rounded, well surpassing scutal process; LAS/side 9 (7-14); postpronotum without setae, but with 1-2 faint sensilla (?) on antero-dorsal border; dorsocentrals usually uniserial, or, if numerous, row staggered posteriorly; DCS/side 10 (7-14), $MaxL_{dcs}$ 187 (158-218); PAS/side 11 (7-16); ScS about 30-42; ASR 0.65 (0.61-0.69); 1-9 setae on epimeral II protuberance.

WING. — L_w 4.0 (3.5-4.6) mm, W_w 1.29 (1.08-1.53) mm. Dry wing not available. Slide mounted wing showing: costal projection 110 (100-120) or 5.7 (5.0-6.1) times its width; Sc as in *D. mendotae* except not quite reaching C; apparent m-cu distal to apparent fCu by about 2-4 times width of apparent m-cu; VR 0.90 (0.88-0.92). Remigium with 1 strong or 1 strong and 1 weak seta on hand, 1-3 setae and about 15 campaniform sensilla just beyond wrist, and 3-4 setae and about 4 large and 8-12 smaller campaniform sensilla on distal 0.5 of forearm. Setae 16 (13-19) on R, 11 (9-12) on R_1, and 5 (3-8) on R_{4+5} (uniserial and dorsal on all). Campaniform sensilla 3-4 ventrally on Sc just beyond arculus, 2 dorsally on R_1, 1 dorsally and 1 ventrally near base of R_{2+3}, and 3-4 dorsally on R_{4+5}. Squama with 35-87 (n = 3) strong setae, $MaxL_{sqs}$ 184-237 (n = 3).

LEGS. — $\overline{L}_{p_I}:\overline{L}_{tot}$ 1.06. Apical tibial spurs essentially as in *D. mendotae*. Polygon pattern on Ti III well developed. Spiniform setae on first 3 tarsomeres of P I-III as follows: 2 (apical)-8, 2 (apical), 0; 11-13, 2 (apical)-5, 0; 16-26, 7-10, 0-1 (at about 0.7). Lengths and ratios of leg segments as follows:

	Fe	Ti	Tm_1	$Tm_{2\text{-}5}$	LR	BV	SV
P_I	1300 (1080–1630)	1500 (1210–1860)	1080 (840–1310)	1340 (960–1430)	0.72 (0.69–0.75)	3.34 (3.23–3.52)	2.60 (2.49–2.72)
P_{II}	1460 (1180–1860)	1430 (1180–1720)	750 (600–940)	900 (710–1140)	0.53 (0.50–0.55)	4.04 (3.90–4.16)	3.85 (3.72–4.00)
P_{III}	1660 (1330–2100)	1740 (1400–2160)	1180 (960–1430)	1180 (990–1450)	0.68 (0.65–0.70)	3.87 (3.71–4.06)	2.86 (2.72–3.00)

HYPOPYGIUM (without reference to *D. mendotae*). — Fig. 133. Tg IX with 12 (5-16) setae/side. Anal point fairly long, slender, broadening basally; well developed apodemes on underside of Tg IX diverging from base of anal point, running to antero-lateral corners of Tg IX. L_{gncx} 319 (295-342); $L_{tot}:L_{gncx}$ 17. Basal plate fairly well developed, with numerous microtrichia ventrally, margin obtuse to right-angled disto-medially. Medial field well developed, with well-delimited dorsal border, with numerous microtrichia and setae; distal end of medial field free. Gonostylus slender, broadest at about 0.3, slightly tapering apically, with subterminal peg and terminal ridge. Sternapodeme a fairly simple slender arch. Basal wedge short but well-developed, rugose laterally.

Diagnosis. — Antenna plumose, eyes not hairy; medial field well-developed, distal end free, dorsal border well-delimited; gonostylus broadest at about 0.3 its length. *D. arctica* is very similar, but its gonostylus is longer and is narrowed more basally and more abruptly and is more slender distally.

Material examined. — *Alaska,* various localities around Anchorage, Aug. and Sept. 1964, 1965, 1966, jeep trap, leg. K. M. Sommerman, 11 males (USNM); Canada, *Alberta,* large mountain stream, Rowe Creek, above highway to Cameron Lake, Waterton National Park, 21.VII.1967, leg. A. L. Hamilton and O. A. Saether, 1 male with pupal exuviae, holotype, CNC type no. 9974 (CNC); *California,* Mono County, Sonora Pass, Leavitt Creek, elv. 8,000′, 18 July 1968, light trap, leg. R. Hellenthal, 3 males (UMn); *California,* Mono County, White Mts., 3 mi. N of Inyo Co., Alt. 10,150′, near Naval Research Station, N. Fork of Crooked Creek, 20-VIII-1963, flight trap, H. B. Leech, 2 males (CalAcad); *Colorado,* 38°31′N, 106°08′W 3.5 miles W of Poncha Springs, sweeping under bridge over Little Arkansas River, 11 Dec. 1968, leg. D. Hansen, 5 males (UMn); *Idaho,* Fremont-Teton Co. border, N. Fork Teton R. at Hwy. 32, 6 Mar. 1965, leg. A. V. Nebeker, 1 male (ANSP); *Montana,* Glacier National Park, Logan Creek at Going to the Sun Highway, 5,800′, 23 July 1968, leg. R. Hellenthal, light trap, 2 males (UMn); as above, but in drift net, 1 male (UMn); *Utah,* Cache Co., Smithfield, 16 Feb. 1969, leg. R. M. and N. Young, flying during light snow, about 30°F., 12 males (UMn); *Utah,* Cache County, Temple Fork of Logan River, I-26-1968, leg. W. D. Pearson, 2 males (UMn); *Utah,* Salt Lake County, Big Cottonwood Creek, various localities along creek, various dates in Nov., Dec. 1964, Jan. to March, June 1965, numerous males (ANSP and UMn); *Wyoming,* 41°20′N, 106°10′W, 3 mi. NNW of Centennial, by Nash Fork of Little Laramie River, 23 March 1968, leg. D. Hansen, 1 male (UMn); *Wyoming,* 44°10′N, 107°05′W, Powder River Pass, 18 mi. W, 13 mi. S of Buffalo, alt. 9,600′, sweeping in fir-spruce forest, 26, 27 Aug. 1967, 27 Aug. 1968, leg. D. Hansen, 7 males (UMn); *Wyoming,* 44°57′40″N, 109°29′00″W, alt. 10,300′, 31 mi. N, 21 mi. W of Cody, sweeping above small spring area at dusk, water 3°C, 13 Aug. 1969, leg. D. Hansen, 2 males (UMn); as above, but drift in small, rocky stream feeding Frozen Lake, 7 PM 13 Aug.-9 AM 14 Aug. 1969, leg. D. Hansen, mature male pupa (UMn).

Discussion. — Saether (1969) described *spinacies* from a male reared from a pupa, a female pupa, pupal exuviae, and larvae. Saether illustrates the hypopygium and shows a fine distal spine on the anal point. I examined the holotype and really can't say that this spine is not just the broken off end of a seta, probably from the gonocoxite. None of my specimens of *spinacies* have such a spine, although they generally agree with the holotype in other respects. The holotype had a lower AR and fewer clypeal, dorsocentral, and prealar setae. The holotype is smaller than the specimens I examined, however, and a reduced number of setae is often found in small specimens of a species.

Until I saw specimens of *arctica,* I was misdetermining *spinacies* as

arctica. The two species are quite close, differing mainly in the shape of the gonostylus.

Saether described *spinacies* from Alberta. I have seen additional specimens from Alaska, California, Colorado, Idaho, Montana, Utah, and Wyoming. At lower elevations it emerges in the winter (and also in the summer?); higher in the mountains it has been collected in the summer months. Streams near or from which I have collected *spinacies* are shown in Figs. 31 and 33.

LOCATION OF TYPES. — Holotype at the CNC; paratypes at the Freshwater Institute, Winnipeg (and the CNC?) (Saether, 1969).

Diamesa vockerothi new species

Description (unless otherwise stated, n = 5 and measurements are in microns): as in *D. mendotae* except:

TOTAL LENGTH. — 5.7 (4.8-6.4) mm (n = 10).

COLORATION (alcohol specimen). — medium to light brown, lateral scutal stripes darker, less pruinose; legs slightly lighter brown; tip of haltere white.

ANTENNA. — longest flagellar seta 0.71 (0.66-0.75)L_{fl}; Flm_{13} with apical 0.15-0.17 spindle-shaped, mainly swollen ventrally; 2-4 short, slender setae dorso- and ventro-medially on Flm_1; long (MaxL 1126-1229) flagellar setae 1 on Flm_1, 4 on Flm_2, 8-10 on Flm_3, 9-11 on Flm_4, increasing to about 14-16 on Flm_{12}, numerous on Flm_{13}; setae on basal 0.1-0.2 of spindle-shaped region of Flm_{13}; $\overline{L}_{flm_{1-13}}:\overline{W}_{flm_{1-13}}$ 111:76, 22:62, 25:62, 26:58, 25:59, 24:56, 22:56, 22:55, 26:54, 26:51, 28:50, 31:48, 1197:47; AR 2.67 (2.53-2.82); 1 or 2 preapical antennal setae; L_{pas} 37 (32-42); D_{pd} 222 (205-234); 1 or 2 pedicellar setae ventro-medially; H_{sc} 235 (213-246).

HEAD. — W_h 807 (768-840); dorsal ocular apodeme weak; epistomal suture strong to weak medially, weak to absent laterally; IOS/side 5 (2-6); PtOS/side 13-17; inner verticals reaching to 0.58 (0.50-0.65) of distance from dorso-medial margin of eye to midline of vertex. CS 17 (10-24); H_e 353 (322-369). $\overline{L}_{ps_{2-5}}:\overline{W}_{ps_{2-5}}:\overline{MaxL}_{pss_{2-5}}$ 142:48:154, 207:56:207, 189:44:162, 254:37:36; D_{so} 19 (16-24); CP 1.02 (0.97-1.04); palpal stoutness 4.22 (4.05-4.41).

THORAX. — L_{th} 1.56 (1.38-1.63) mm, D_{th} 1.48 (1.33-1.55) mm. Antepronotum with medial commissure strong, not quite reaching to rear margin of phragma I, slightly to well surpassing anterior margin of scutal process; antepronotal notch weak, acute to obtuse, with medial corners rounded; LAS/side 8 (6-11). Dorsocentrals uniserial or slightly staggered posteriorly; DCS/side 10.5 (8-13), $MaxL_{dcs}$ 236 (188-262); PAS/side 10 (8-12); Scs 37 (27-44), $MaxL_{scs}$ 268 (229-311); ASR 0.62 (0.59-0.64); 1-4 setae on epimeral II protuberance.

WING. — L_w 4.3 (3.9-4.4) mm, W_w 1.31 (1.21-1.39) mm. Dry wing not available. Slide mounted wing showing: costal projection 142 (115-170) or 6.8 (5.8-8.9) times its width; VR 0.92 (0.91-0.94). Remigium with 1 strong seta on hand, 0-1 weak seta and about 11-16 campaniform sensilla just beyond wrist, and 2-3 setae and 4 large and about 6-11 smaller campaniform sensilla on distal 0.5 of forearm. Setae 16 (13-20) on R, 10 (8-11) on R_1, and 7 (5-8) on R_{4+5} (uniserial and dorsal

on all). Campaniform sensilla 3 ventrally on Sc just beyond arculus, 2-3 dorsally on R_1, 1-2 dorsally and 1 ventrally near base of R_{2+3}, and 2-7 dorsally on R_{4+5}. Squama with 43-61 strong setae, $MaxL_{sqs}$ 188-229.

LEGS. — $\bar{L}_{p_I}:\bar{L}_{tot}$ 1.16; Fe I with moderate postero-dorsal beard of about 10-20 long setae on proximal 0.5. Apical spur of Ti I long, slender, with somewhat sparse prickles on basal 0.3-0.4; L_{tispI} 100 (90-107); apical spurs otherwise essentially as in *D. mendotae*. Ti III with posterior comb of about 19-23 spines arranged in a fairly regular single row. Spiniform setae on first 3 tarsomeres of P I-III as follows: 4-9, 2-3, 0-1 (at about 0.7); 9-12, 5-7, 0-2 (at about 0.6); 13-17, 8-10, 0-2 (at about 0.5). Lengths and ratios of leg segments as follows:

	Fe	Ti	Tm_1	$Tm_{2\text{-}5}$	LR	BV	SV
P_I	1810 (1680–1890)	2040 (1860–2100)	1350 (1210–1450)	1430 (1360–1510)	0.66 (0.64–0.69)	3.65 (3.49–3.75)	2.85 (2.75–2.92)
P_{II}	1990 (1830–2060)	1850 (1690–1960)	900 (820–940)	1140 (1080–1180)	0.49 (0.47–0.50)	4.17 (4.04–4.32)	4.27 (4.17–4.35)
P_{III}	2240 (1990–2370)	2240 (2060–2370)	1430 (1230–1580)	1500 (1330–1650)	0.64 (0.59–0.67)	3.96 (3.83–4.11)	3.14 (3.00–3.31)

HYPOPYGIUM (without reference to *D. mendotae*). — Figs. 127, 128. Tg IX with 14 (10-17) setae/side. Anal point strong, broadening just slightly basally, usually with short apical peg; strong apodemes on underside of Tg IX diverging, arching to antero-lateral corners of Tg IX; L_{gncx} 351 (328-374); $\bar{L}_{tot}:\bar{L}_{gncx}$ 16. Basal plate quite well developed, but with disto-medial margin not projecting. Medial field well developed, dorsal border fairly well delimited, becoming just slightly free from gonocoxite distally; medial field with numerous microtrichia, with setae particularly strong ventrally; distal end of medial field fairly broad, slightly curving mesad; medial field with 3-8 setae in proximo-dorsal corner. Basimedial setal cluster with numerous extremely long, strong setae radiating fan-like, longest setae reaching beyond mid-line of opposite gonocoxite. Gonostylus broadest at about 0.5, with subterminal peg and short terminal ridge. Sternapodeme slender medially, with or without anterolateral projection; fore margin straight to moderately concave medially. Basal wedge quite strong, rugose, extending not quite to distal end of basal plates.

DIAGNOSIS. — Antenna plumose, eyes hairy; basal plate not produced disto-medially; basimedial setal cluster strong; medial field with distal end free, broad, directed postero-mesad.

MATERIAL EXAMINED. — *Ontario,* Bells Corners, 21.III.1956, G. E. Shewell, on snow beside semi-permanent low-land stream, 3″-1′ deep, 3′-5′ wide, bottom rocky and pebbly with moss, *Diamesa nivoriunda* (Fitch), det. 1956 J. R. Vockeroth, 11 males, 9 females (all teneral) (CNC); Loon Lake nr. Essonville, 15-III-1965, Martin and McAlpine, 3 males (CNC); Ottawa, 21.III.1957, J. R. Vockeroth, about 30 males (CNC): Ottawa, 31.III.1957, J. R. Vockeroth, *Diamesa nivoriunda* (Fitch),

det. J. R. V. '57, numerous males (CNC); *Quebec*, Gatineau Pk., Notch Rd. Q 10/2, 6.III.1966, D. R. Oliver, 9 males, 1 female (CNC); Gatineau Pk., Q-15-1, 1.III.1964, D. R. Oliver, 5 males (CNC); Old Chelsea, 28.III.1958, J. R. Vockeroth, *Diamesa nivoriunda* Fitch det J. R. V. '58, 2 males, 4 females (CNC); Shawano, Gatineau Park, 26.II.1966, P. S. Corbet, 1 male (CNC).

LOCATION OF TYPES. — Holotype is a slide-mounted male collected: Ontario, Ottawa, 21.III.1957, J. R. Vockeroth, slide DH70-60; it is deposited in the CNC. All other male specimens examined are designated as paratypes and are deposited in the CNC and UMn.

DISCUSSION. — *D. vockerothi* has been collected at a few localities in Ontario and Quebec. The species is named in honor of Dr. J. R. Vockeroth, the collector of a long series of specimens and an excellent Dipterist. The species has the highest AR (up to 2.82) of any species of *Diamesa* I know of.

List of Synonyms or Preoccupied Names

banana Garrett (= *heteropus*)
biappendiculata Goetgh. (= *geminata*)
borealis (*Eutanypus*) Coq. (= *coquilletti* Sublette; see also *heteropus*)
borealis Garrett (preoccupied; = *garretti* Sublette and Sublette)
Brachydiamesa sp. II Thienemann, 1936 (= ?*lindrothi*)
caena Roback (= *leona*)
confusa (*Adiamesa*) Garrett (= *heteropus*)
D. sp. I Pagast (see *geminata*)
D. sp. II Thienemann, 1941; Pagast, 1947 (see *bertrami*)
D. sp. VII Thienemann, 1941; Pagast, 1947 (= *incallida*)
edwardsi Goetgh. (= *bohemani*)
fonticola Saether (= *incallida*)
furcata Edw. (= *geminata*)
nexilis Walker (= *incallida*)
onteona Roback (= *heteropus*)
pieta Roback (= *leona*)
poultoni Edw. (= *arctica*)
prolongata Kieff. (= *insignipes*)
waltlii Meigen (see: *aberrata, bohemani, chiobates, nivoriunda*)

Other Species Recorded as Diamesa

Several other species assigned to *Diamesa* at one time or another have been described or recorded from the Nearctic. My placement of these species is as follows:

D. appendiculata Lundstroem 1918(?): 23-24, Fig. 35 (described from arctic Siberia). Sublette determined specimens from the Cape Thompson Region, Alaska (recorded in Watson, D. G., J. J. Davis, and W. C. Hanson. 1966. Ch. 21. Terrestrial Invertebrates, p. 565-584. *In* Wilimovsky, N. J., *ed.* Environment

of the Cape Thompson region, Alaska. U.S. Atomic Energy Commission, Division of Technical Information, Oak Ridge. xvi + 1250 p., maps). I have seen these specimens and am certain the species does not belong in *Diamesa*. The gonostylus is somewhat similar to *Paraheptagyia tasmaniae* (Freeman) (Brundin, 1966), although the phallapodeme and other hypopygial features are nearer to *Sympotthastia fulva*. I really don't know where it belongs.

D. fulva Johannsen. Sublette and Sublette (1965: 151) listed *fulva* as a *Diamesa*, and Sublette (1967b: 480-483) later redescribed the type material and regarded *fulva* as a *Diamesa*. I am regarding it as a *Sympotthastia* Pagast.

D. longimanus (Kieffer). Sublette and Sublette (1965: 151) regard *Potthastia* Kieffer as a junior synonym of *Diamesa*. I regard *Potthastia* as a distinct genus. The nearctic species of *Potthastia* are *longimanus* Kieff., *gaedii* (Meigen), possibly *montium* (Edw.), and a new species from Wyoming near *montium*.

D. parva Edw. Sublette and Sublette (1965: 152) regard *parva* as a *Diamesa*. I regard it as belonging to *Diplomesa* Pagast (= "*Pseudokiefferiella*" Zavrel).

D. polaris Kieffer 1926: 79. Kieffer described *polaris* from a female from "Rice Straith" (eastern coast of Ellesmere Island). The brown haltere and shape of r-m ("T^1") mentioned by Kieffer suggest that *polaris* is a *Diplomesa*. I'd be inclined to call it a *nomen dubium*.

D. sequax (Garrett). Sublette and Sublette (1965: 152) included *sequax* in *Diamesa*. Sublette (1967a: 305-306) later erected the monotypic genus *Hesperodiamesa* for *sequax*.

D. ursus Kieffer. Edwards (1935: 470) recorded 7 females from eastern Greenland. At this point, I simply can't determine female *Diamesa* with any certainty and would regard Edwards' determination as being questionable.

D. waltlii Meigen. Johannsen (1903: 439, 441, pls. 47, 48; 1921: 230-232) misdetermined *D. nivoriunda* as "*Waltlii*." Malloch (1915: 410-411; Fig. 11, pl. 23; Fig. 3, pl. 29; Fig. 1, pl. 35) recorded *D. waltlii* from Maryland, Colorado, and Montana. He also described the larva, pupa, and adult, stating that the larvae were common in the Illinois River. The hypopygial figure looks like *D. heteropus* or *chiobates*. I have not seen Malloch's material, but I suspect the Montana and Colorado records are probably *heteropus*, the Maryland record *nivoriunda*. Knowlton (1931: Can. Ent. 63: 152) recorded *D. waltlii* from Utah. I have not seen his specimens, but he probably was seeing *heteropus*. Cole (1969: 99) cites literature records of *waltlii*. Again, *heteropus* is probably the species originally seen.

List of Abbreviations

Abbreviations used in the descriptions.

AcS	acrostichal setae
AR	antennal ratio (Fig. 47)
BV	see Fig. 146
CP	ratio of head width to palpal length
CS	clypeal setae
DCS	dorsocentral setae
D_{pd}	diameter of pedicel
D_{so}	diameter of sunken organ (Fig. 57)

D_{th}	depth of thorax (Fig. 143)
Fe I, II, III	fore, mid, and hind femur, respectively
flm_n	n^{th} flagellomere
fR	point of forking of radius to form R_1, R_{2+3}, and R_{4+5}
H_e	height of eye (Fig. 142)
H_{sc}	height of scape (Fig. 142)
IOS	interocular setae (Fig. 48)
LAS	lateral antepronotal setae (Fig. 78)
$L_{atispIII}$	length of antero-ventral spur on hind tibia
L_{fl}	length of flagellum
$L_{flm_{1-13}}$	length of each flagellomere (Fig. 39)
L_{gncx}	length of gonocoxite
L_{pas}	length of preapical antennal seta
L_{pl}	length of fore leg
$L_{ptispIII}$	length of postero-ventral spur on hind tibia
$L_{ps_{2-5}}$	length of palpal segments 2 to 5 (Fig. 57)
LR	leg ratio
L_{th}	length of thorax (Fig. 143)
L_{tispI}	length of spur on fore tibia
L_{tot}	total length of insect, from tip of antepronotum to end of hypopygium
L_w	length of wing (Fig. 144)
MaxL	maximum length
$MaxL_{dcs}$	length of longest dorsocentral seta
$MaxL_{pss_{2-5}}$	length of longest seta on palpal segments 2 to 5
$MaxL_{sqs}$	length of longest squamal seta
PAS	prealar setae (Fig. 65)
P I, II, III	fore, mid, and hind legs, respectively
n	number (sample size)
PS_1	first palpal segment (Figs. 48, 56)
PtOS	postocular setae (Fig. 49)
PTP	posterior tentorial pit (Fig. 60)
ScS	scutellar setae
St IX	ninth sternite (Figs. 119, 131)
SV	see Fig. 146
Tg IX	ninth tergite (Fig. 131)
Ti I, II, III	fore, mid, and hind tibia, respectively
Tm_n	n^{th} tarsomere ("tarsal segment")
$W_{flm_{1-13}}$	width of each flagellomere (Fig. 39)
W_h	width of head (excluding height of ommatidia) (Fig. 142)
W_w	maximum width of wing (Fig. 144)
—	bar; average or mean value

Abbreviations of institutions and/or individuals from which material was borrowed.

ANSP	Academy of Natural Sciences of Philadelphia
BM(NH)	British Museum (Natural History), London
CalAcad	California Academy of Sciences (through JES)
CalfInsSur	California Insect Survey (through JES)
CNC	Canadian National Collection, Ottawa
ColStU	Colorado State University, Ft. Collins
Corn	Cornell University, Ithaca
HKT	Dr. Henry K. Townes, American Entomological Institute, Ann Arbor, Michigan
IllNatHstSur	Illinois Natural History Survey, Urbana
JES	Dr. James E. Sublette, Eastern New Mexico University, Portales. New Mexico
UBC	University of British Columbia, Vancouver
UCalDav	University of California, Davis
UId	University of Idaho, Moscow
UMich	University of Michigan, Ann Arbor
UMn	University of Minnesota, St. Paul
USNM	United States National Museum, Washington, D.C.
UtStU	Utah State University, Logan
UWyo	University of Wyoming, Laramie
WashStU	Washington State University, Pullman
WWSU	Western Washington State University, Bellingham

TABLE I. — Wing venation terminologies

Fig. 93		Walker, 1856	Schiner, 1864b	Goetghebuer, 1927	Edwards, 1929
C	costa	costal	Costalader	costale	costa
h	humeral crossvein	—	—	—	—
Sc	subcosta	mediastinal	Mediastinalader	auxiliaire	subcosta
R	radius	subcostal	Subcostalader	radius	radius
R_1		subcostal	Subcostalader	radius	R_1
R_{2+3}		radial	Radialader	2e longitudinal	R_{2+3}
R_{4+5}		cubital	Cubitalader	cubitus	R_{4+5}
r-m	r-m crossvein	praebrachial transverse veinlet	Querader	T_1, transversale anterieure	r-m
M	media	[?]	Discoidalader	discoidale	media
M_{1+2}		subapical	"	discoidale	media
M_{3+4}		[?] subanal	"	P_1, rameau anterieur de la posticale	Cu_1
apparent m-cu		["pobrachial areolet closed"]	Hintere Querader	T_2, transversale posterieure	m-cu
Cu	cubitus	pobrachial	Posticalader	—	cubitus
apparent fCu	apparent forking of Cu	fork of pobrachial vein	—	—	base of cubital fork
Cu_1		[?] anal	Posticalader	P_2, rameau posterieur de la posticale	Cu_2
Vannal fold		—	—	—	—
An	anal vein	[?] subaxillary	Analader	A	An
Anal lobe		—	—	—	anal lobe
Remigium		—	—	—	stem vein

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[9] Abbreviations of journal titles generally follow Brown and Stratton, 1963.

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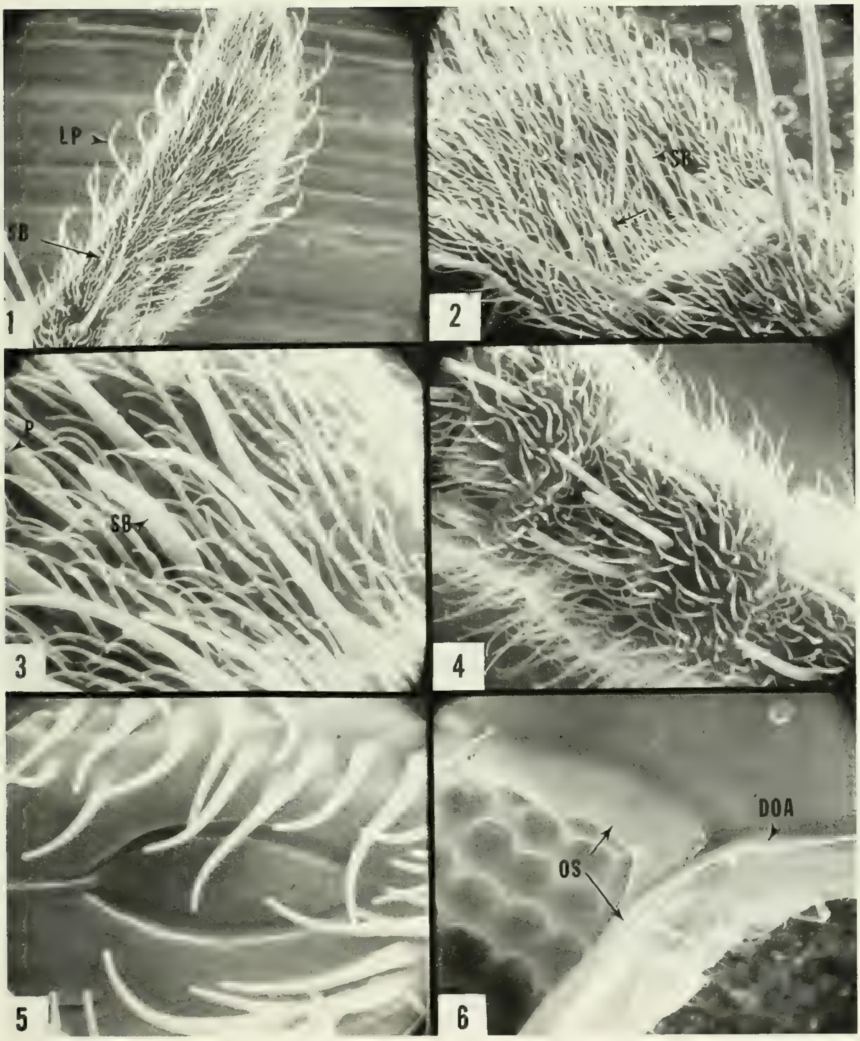
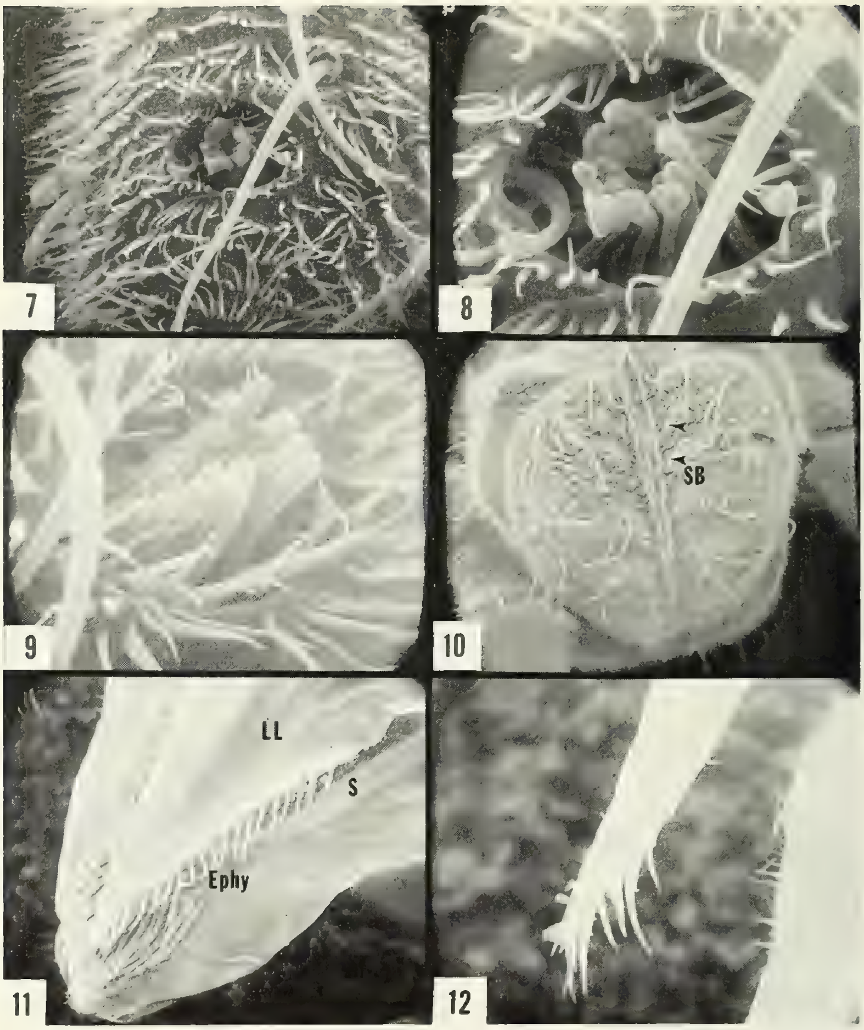
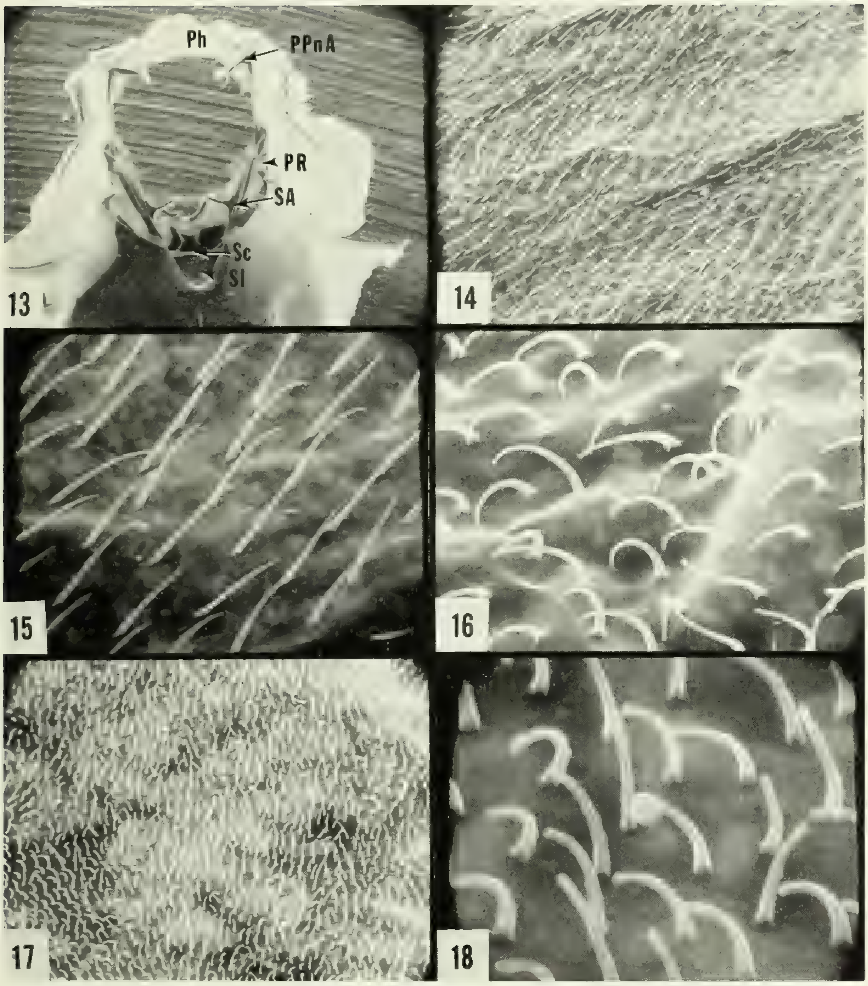
FIGS. 1-6. — Fig. 1. Ultimate flagellomere of *D. nivicavernicola,* 800×. Note the numerous long, pointed sensilla basiconica (LP) and the five short, blunt sensilla basiconica (SB); Fig. 2. Proximal end of ultimate flagellomere of *D. nivicavernicola,* 1,700×. Arrows point to two of at least five short, blunt sensilla basiconica (SB). Also note the large setal sockets and the ridged setae; Fig. 3. Portion of ultimate flagellomere of *D. nivicavernicola,* 4,500×. Note the numerous microtrichia, the several long, pointed sensilla basiconica, and the two short, blunt sensilla basiconica (SB). Also note the apparent presence of fine pores (P) on one of the short, blunt sensilla basiconica; Fig. 4. Flm_6 (dorsal view) and proximal region of Flm_7 of *D. nivicavernicola,* 2,000×. Note that the sensilla arise from small pits; Fig. 5. Sensillum on pedicel of *D. mendotae,* 9,000×; Fig. 6. Dorso-medial region of eye and adjacent vertex of *D. mendotae,* internal view, 1,050×. Note the internally-projecting ocular sclerite (OS) and the dorsal ocular apodeme (DOA).

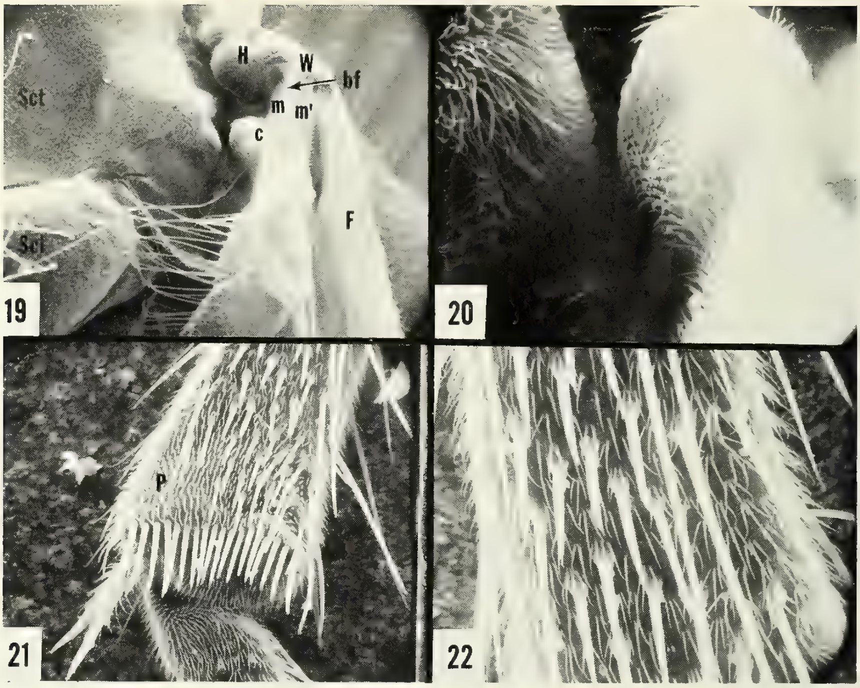

LP
SB
1
SB
2
P
SB
3
4
5
DOA
OS
6



FIGS. 7-12. — Fig. 7. Sunken organ on the third palpal segment of *D. mendotae,* 2,050×; Fig. 8. As above, but 5,100×; Fig. 9. As above; Fig. 10. Labella of *D. mendotae,* ventral view, 490×. Note the small sensilla basiconica (SB); Fig. 11. Postero-ventral view of labial lonchus (LL) and epipharynx (Ephy) of *D. mendotae,* 1,050×. The labella were removed to show these structures. Note the strengthening sclerite (S) on the posterior surface of the epipharynx (cf. Fig. 59) and the numerous seta-like spines; Fig. 12. Distal end of lacinia of *D. mendotae,* 2,100×.

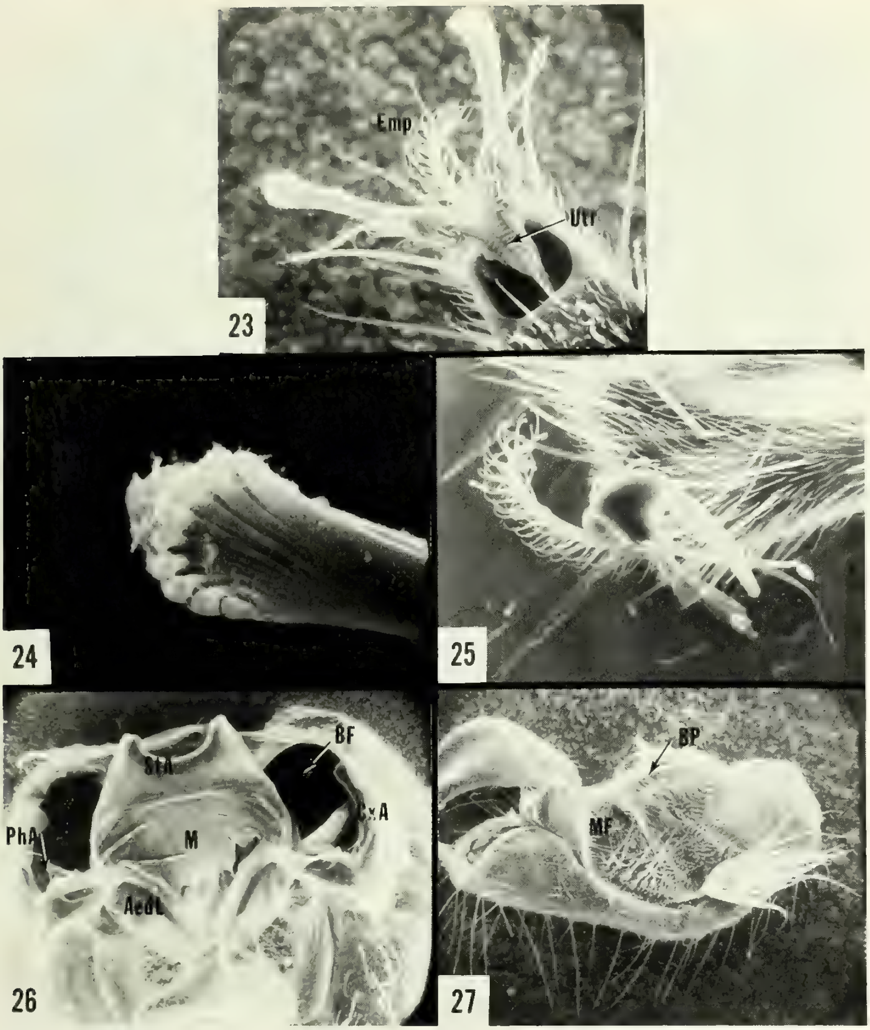


FIGS. 13-18. — Fig. 13. Internal view (looking anteriorly) of prothorax of *D. mendotae*, 90×. Phragma I (Ph) and the postpronotal apophyses (PPnA) are visible dorsally, while the sternal apophysis (SA) is seen to fuse with the pleural ridge (PR). The sternacosta (Sc) marks the fore margin of the sternellum (Sl); Fig. 14. Microtrichia on wing membrane of *Boreoheptagyia lurida* (region photographed was between R_{4+5} and M_{1+2}), 600×. Note that the wing surface is slightly irregular, presumably giving the "punctured" appearance when the wing is viewed dry. Fig. 15. Same wing as above, 2,400×; Fig. 16. Wing microtrichia of *D. mendotae*, 5,500×; Fig. 17. Wing microtrichia of *Potthastia* sp., 2,100×; Fig. 18. As above, 21,000×. Note the different magnifications of Figs. 15, 16, and 18 needed to bring the microtrichia to approximately the same length.

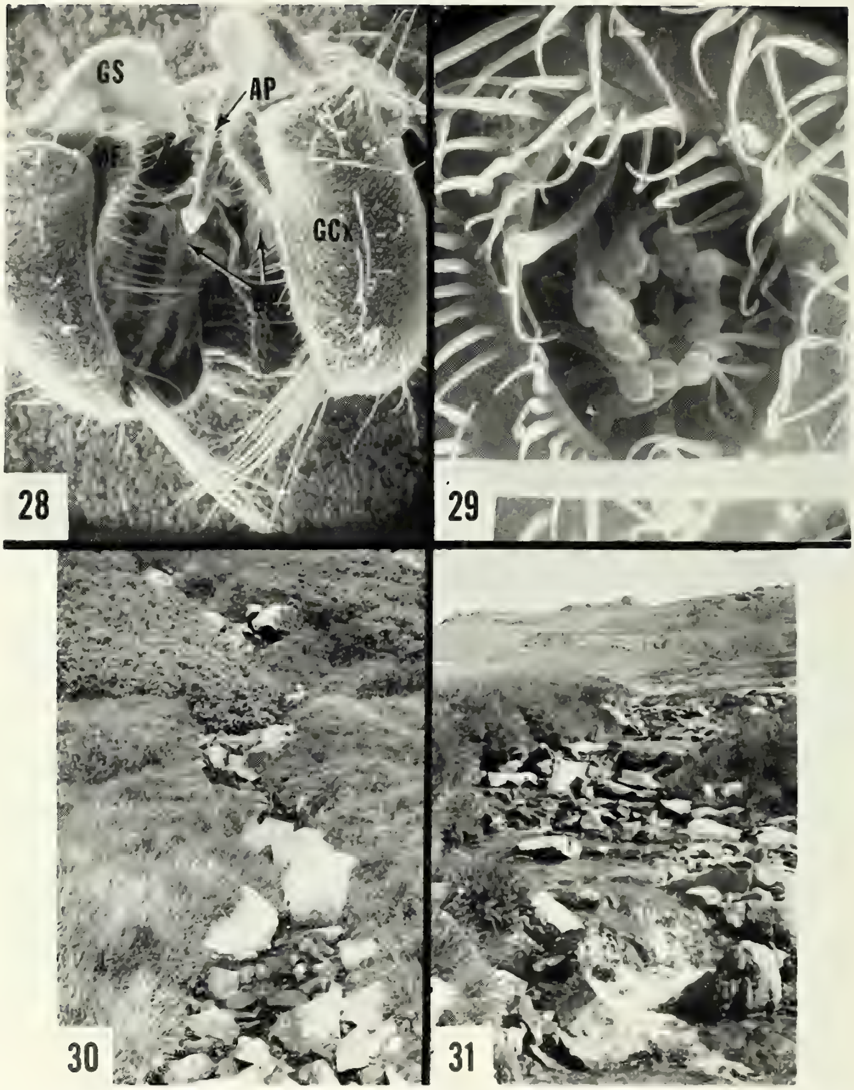


FIGS. 19-22. — Fig. 19. Wing base and adjacent thoracic region of *D. mendotae*, wing in rest position, 240×. Scl = scutellum. Note that the tip of the third axillary sclerite (c) contacts (here slightly removed from) a raised portion on the scutum (Sct) (cf. Fig. 89). Compare this photo with Snodgrass (1935), Fig. 113. The hand (H) of the remigium cups over projections of the first (cf. Figs. 89, 92) and second (cf. Figs. 89, 91) axillary sclerites (axillary sclerites not visible here). The remigium bends at its weak wrist (W), so the forearm (F) lies parallel to the body of the insect. "bf" is the *plica basalis* (Snodgrass, 1935: 238), the line of flexion between the proximal (m) and distal (m') medial plates. Also note the fine microtrichia on the scutum and scutellum; Fig. 20. Microtrichia-covered distal end of the third axillary sclerite ("c" above), 1,200×. Note that the hooked microtrichia lock with a group of similar microtrichia on the scutum when the two regions are appressed; Fig. 21. Posterior view of Ti III of *D. mendotae*, 500×. "P" marks the region of the polygon pattern visible in cleared material (cf. Fig. 109). Note the short, stout setae on the posterior surface of the tibia and the microtrichia on the tibial spurs; Fig. 22. Ti III of *D. mendotae*, about at mid-length, 1,000×. Note the ridged, short, stout setae and the grouped microtrichia.

FIGS. 23-27. — Fig. 23. Posttarsus of mid-leg of *D. mendotae*, 1,000×. Emp = empodium, Utr = unguitractor plate; Fig. 24. Tip of claw of above, 5,300×; Fig. 25. Claws and empodium of *D. nivicavernicola*, 870×. Note the lateral tooth; Fig. 26.



Bases of gonocoxites of *D. mendotae*, 220×. The gonocoxites have been removed from the body, and the ninth tergite, ninth sternite, and proctiger have also been removed. The coxapodeme (CxA) is the strong lateral rim of the basal foramen (BF). The two aedeagal lobes (AedL) of the intromittant organ articulate to the coxapodeme and the sternapodeme (StA), while the phallapodeme (PhA) projects into the cavity of the gonocoxite. Note the dorsal membrane (M) of the intromittant organ extending from the aedeagal lobes to the sternapodeme; Fig. 27. Medial view of left gonocoxite of *D. mendotae*, 210×. Note the basimedial setal cluster, the basal plate (BP) with microtrichia on its ventral surface, and the free distal end of the medial field (MF).

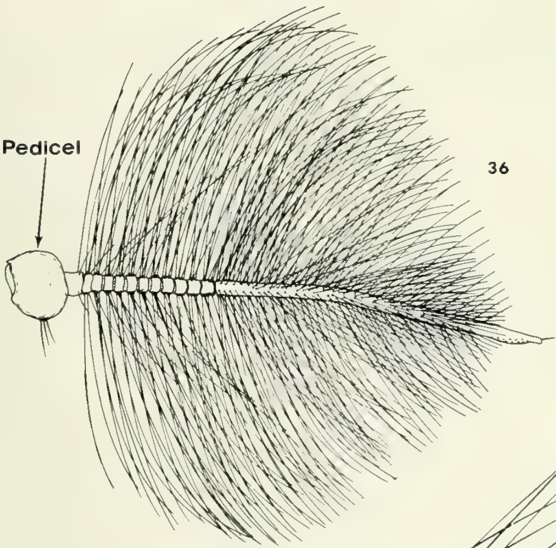


FIGS. 28-31. — Fig. 28. Posterior view of hypopygium of *D. mendotae,* 210×. GS = gonostylus, Gcx = gonocoxite, AP = anal point, BP = basal plate, MF = medial field (here the free end of it); Fig. 29. Sunken organ on the third palpal segment of *D. mendotae,* 4,600×; Fig. 30. Small, steep stream feeding Frozen Lake, Bear Tooth Mountains, Wyoming, alt. 10,300′. *D. leoniella* adults were found on the rocks above the splash line, and a male pupa of *D. chorea,* with the cast larval skin, was collected in a silk and sand case from a rock. Note drift trap at center;

FIGS. 32-35. — Fig. 32. Stream feeding unnamed lake, Bear Tooth Mountains, Wyoming, alt. 9,640′, 44°58′26″N, 109°33′12″W; water temp. 14°C (early afternoon). *D. leoniella* adults were common just above splash line on rocks; larvae and pupae of *leoniella* were found on the rock surface where the water ran in a shallow sheet. Drift trap at lower right; Fig. 33. Bridge across South Arkansas River, Colorado, Dec. 11, 1968. Adults of *D. heteropus* and *spinacies* were swept from under the bridge, where they had been resting on the beams. Adults of *D. leona* were taken in a similar stream by turning over the ledge ice and looking in the honeycombed ice; Fig. 34. Arkansas River, 6 mi. NW of Salida, Colorado, Dec. 11, 1968. Adults of *D. leona* were taken from a cluster of rocks in mid-stream (see Fig. 35); Fig. 35. As above. Adults of *D. leona* were found on the rocks or under the small pieces of ice.

Fig. 31. Small, rocky stream feeding Frozen Lake, Bear Tooth Mountains, Wyoming, alt. 10,300′. Pupae or pupal exuviae of *D. chorea, garretti, heteropus,* and *spinacies* were taken from this stream. Drift trap at upper left center.

FIGS. 36-39. — Fig. 36. Plumose antenna of *D. mendotae;* Fig. 37. Spindle-shaped apex of Flm_{13} of *D. mendotae.* PAS = preapical antennal seta; Fig. 38. Antenna of *D. cinerella;* Fig. 39. Proximal three flagellomeres of antenna of *D. mendotae.*



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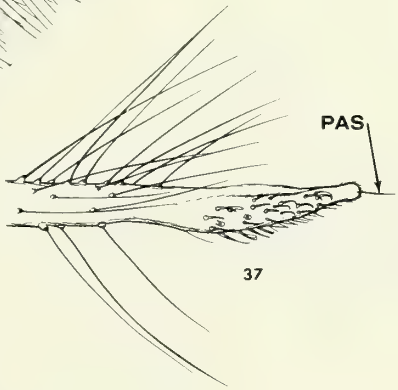

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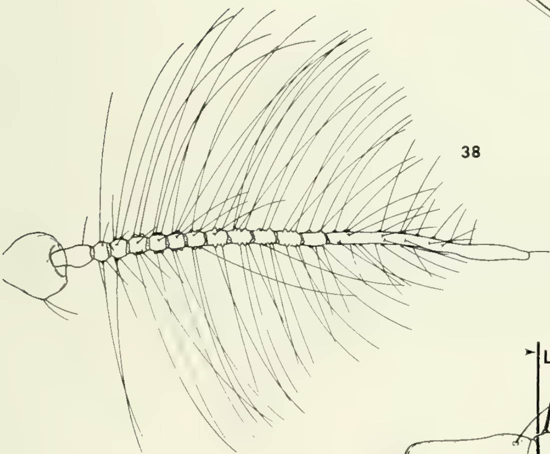

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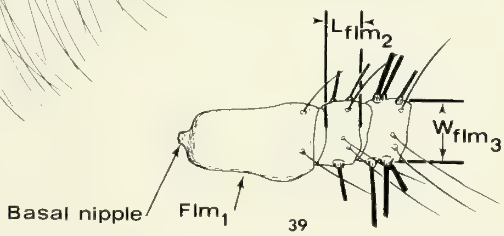
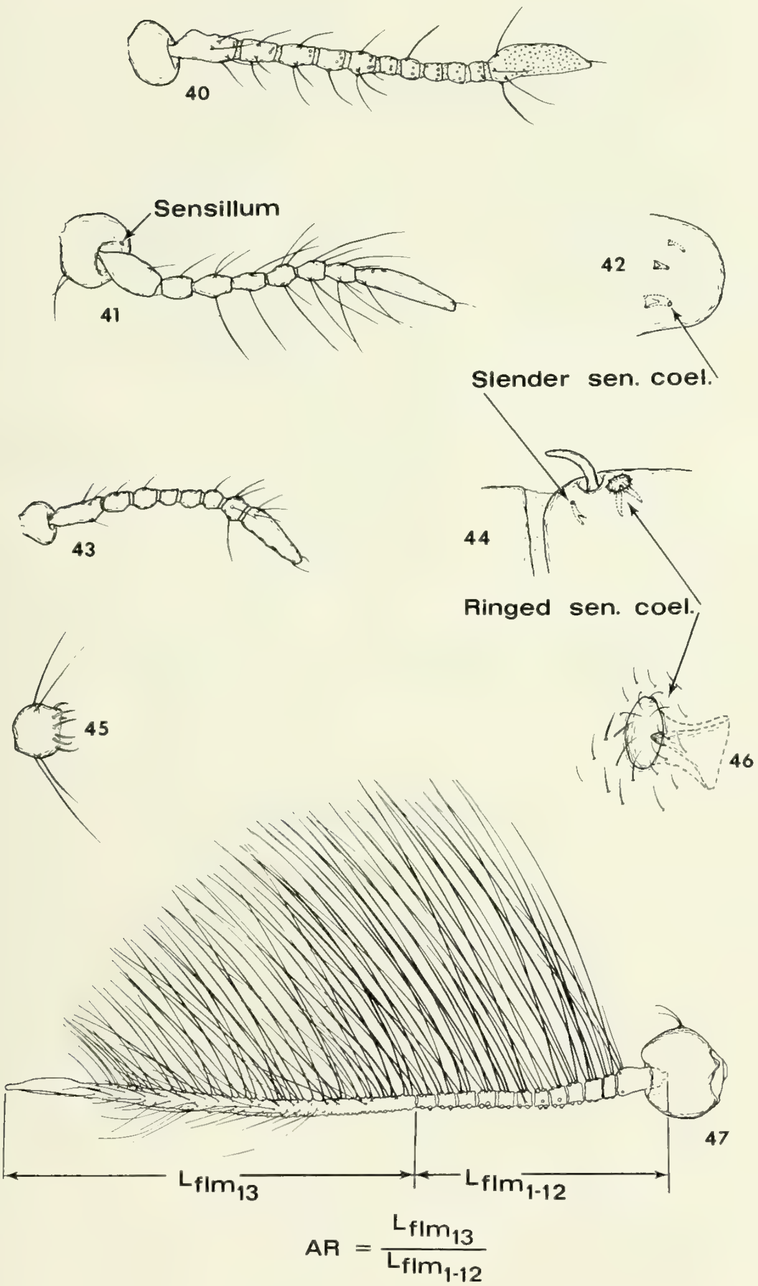
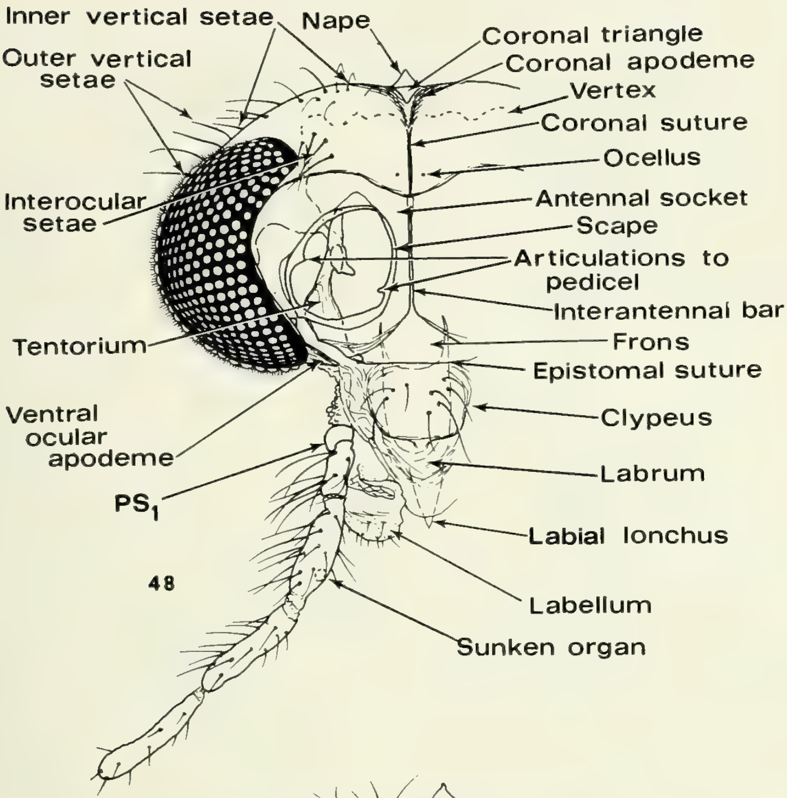


39

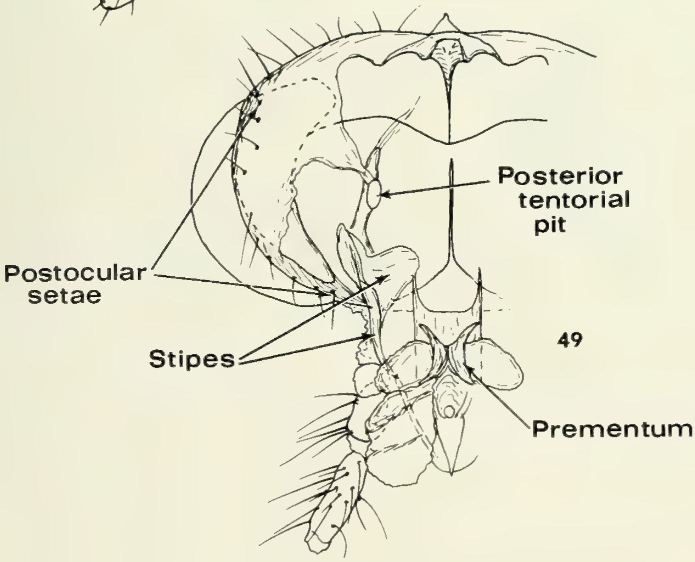
FIGS. 40-47. — Fig. 40. Antenna of *D. nivicavernicola.* Small circles show locations of the sensilla basiconica; Fig. 41. Antenna of *D. coquilletti;* Fig. 42. Small sensilla coeloconica at apex of antenna; Fig. 43. Antenna of *D. amplexivirilia.* Fig. 44. Sensilla at distal end of Flm_1 of *D. coquilletti;* Fig. 45. Flm_7 of *D. amplexivirilia* showing the long, pointed sensilla basiconica; Fig. 46. Ringed sensillum coeloconicum; Fig. 47. Diagramatic antenna, showing AR.


40
Sensillum
41
42
Slender sen. coel.
43
44
Ringed sen. coel.
45
46
47
$L_{flm_{13}}$
$L_{flm_{1-12}}$
$AR = \frac{L_{flm_{13}}}{L_{flm_{1-12}}}$

FIGS. 48-49. — Fig. 48. Head of *D. mendotae;* Fig. 49. Head of *D. mendotae,* posterior view.

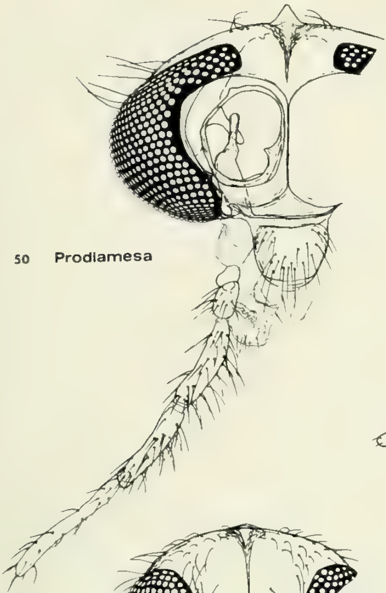

Inner vertical setae
Nape
Coronal triangle
Coronal apodeme
Outer vertical setae
Vertex
Coronal suture
Ocellus
Interocular setae
Antennal socket
Scape
Articulations to pedicel
Interantennal bar
Tentorium
Frons
Epistomal suture
Ventral ocular apodeme
Clypeus
Labrum
PS1
Labial lonchus
Labellum
Sunken organ

48

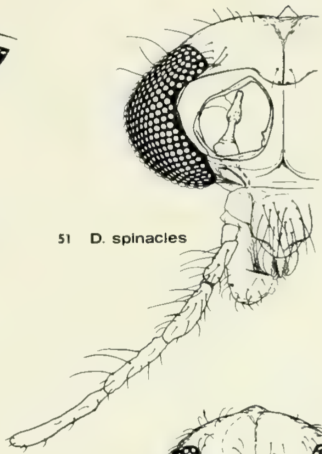

Posterior tentorial pit
Postocular setae
Stipes
Prementum

49

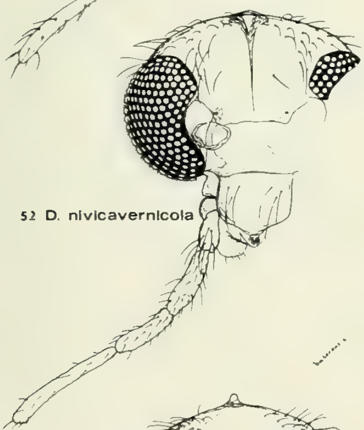
Figs. 50-55. — Self-explanatory.



50 Prodiamesa

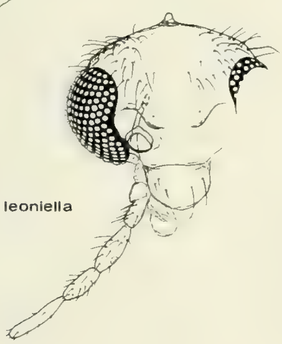


51 D. spinacies

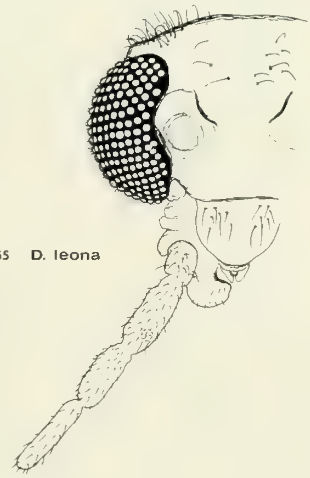


52 D. nivicavernicola

53 D. amplexi-
virilia

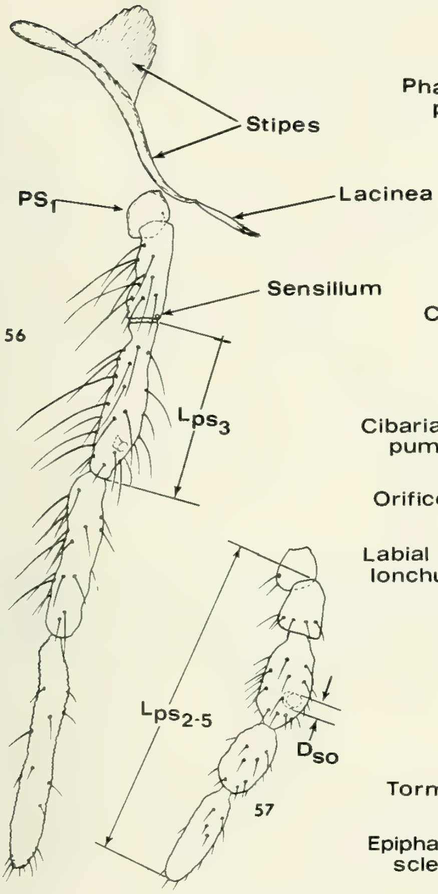


54 D. leoniella



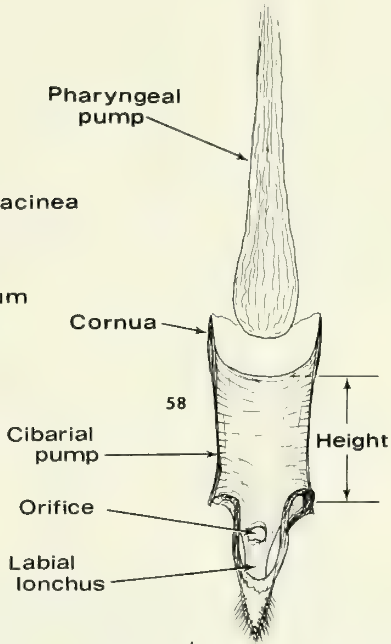
55 D. leona

FIGS. 56-62. — Fig. 56. Maxilla of *D. mendotae.* Note the small first palpal segment (PS_1) articulating to the stipes; Fig. 57. Palpus of *D. leona;* Fig. 58. Cibarial pump, etc. of *D. mendotae.* The height is measured from the articulation of the torma to the center of the concave dorsal margin; Fig. 59. Cibarial pump, etc., of *D. leona.* The sclerite on the epipharynx (cf. Fig. 11) forms a "U" running between the articulations of the tormae to the cibarial pump; Fig. 60. Tentorium and ventral region of eye of *D. mendotae.* Note the strong ventral ocular apodeme (cf. Fig. 48); Fig. 61. Tentorium and ventral region of eye of *D. nivicavernicola.* Note the absence of a ventral ocular apodeme; Fig. 62. Tentorium and ventral region of eye of *D. davisi.*

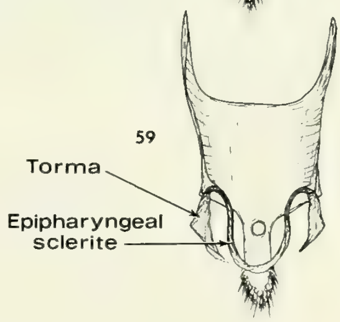


56

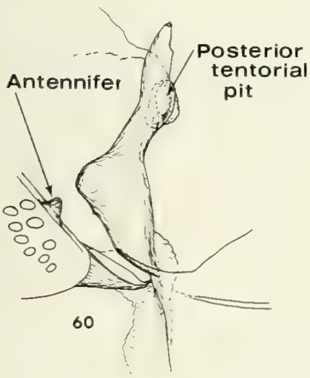
57



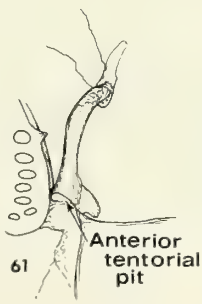
58



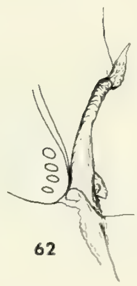
59



60



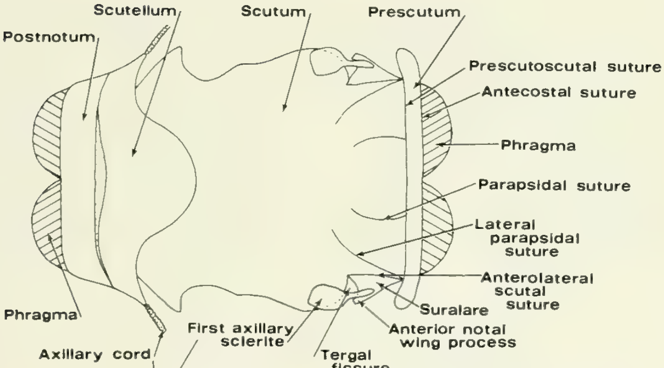
61

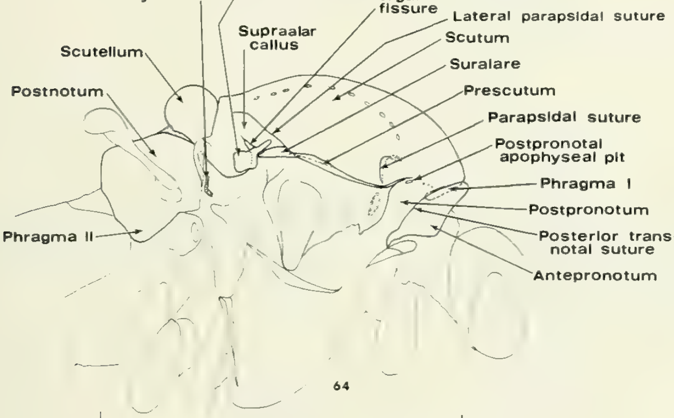


62

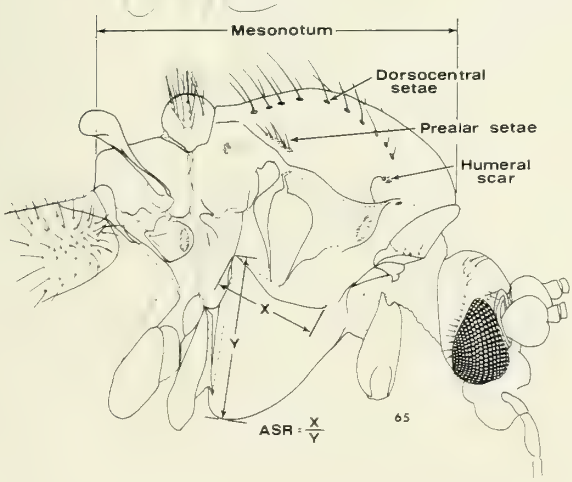
FIGS. 63-65. — Fig. 63. Primitive or hypothetical notum, modified slightly from Snodgrass, 1935, and Matsuda, 1970: Fig. 3. Some sutures were omitted for clarity; Fig. 64. Pro- and mesonotal regions of *D. mendotae.* Parts of metathorax and various sclerites at base of wing omitted; Fig. 65. Thorax of *D. mendotae.* ARS = anapleural suture ratio.

63


Scutellum
Scutum
Prescutum
Postnotum
Prescutoscutal suture
Antecostal suture
Phragma
Parapsidal suture
Lateral parapsidal suture
Anterolateral scutal suture
Suralare
Phragma
Anterior notal wing process
First axillary sclerite
Axillary cord

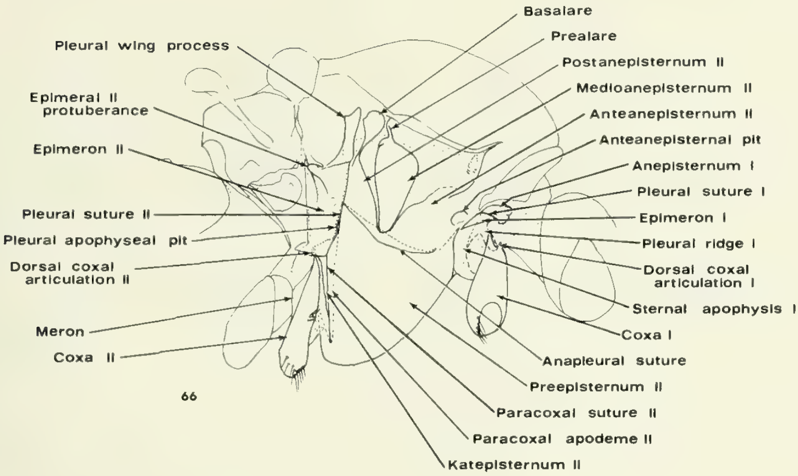

Tergal fissure
Lateral parapsidal suture
Supraalar callus
Scutum
Scutellum
Suralare
Postnotum
Prescutum
Parapsidal suture
Postpronotal apophyseal pit
Phragma I
Postpronotum
Phragma II
Posterior trans-notal suture
Antepronotum

64

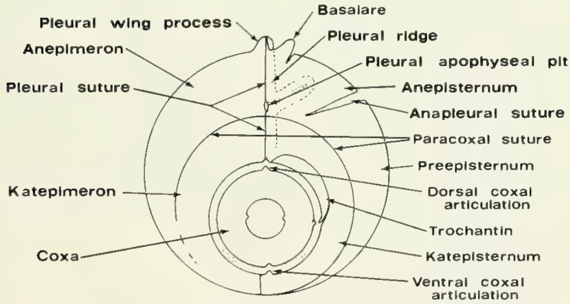

Mesonotum
Dorsocentral setae
Prealar setae
Humeral scar
X
Y
ASR = X/Y

65

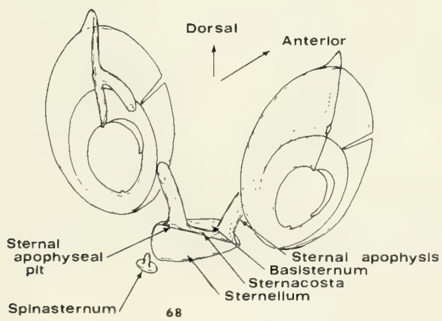
Figs. 66-68. — Fig. 66. Pleural regions of pro- and mesothorax of *D. mendotae;* Fig. 67. Primitive pleuron, modified from Matsuda, 1970: Fig. 14; Fig. 68. The two primitive pleural regions and the primitive sternal sclerites in a pterothoracic segment, viewed posterolaterally.



66



67 Primitive pleuron Anterior →



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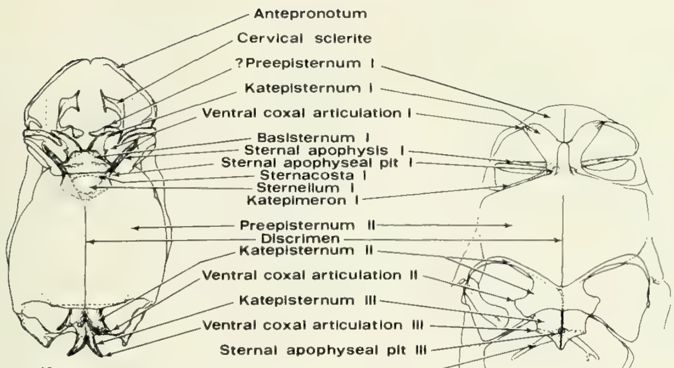
FIGS. 69-74. — Fig. 69. Ventral view of thorax of *D. mendotae.* The sternal apophyseal pit I is more readily visible from a ventro-lateral view. No sternal apophyseal pits are visible in the meso- and metathorax; Fig. 70. Ventral view of thorax of *Sphaeromias* (Ceratopogonidae). This is an interesting thorax. The strong anterior-most sclerite is probably preepisternum I. The sternal apophyseal pits are readily visible in both the pro- and metathorax. Note that katepisternum II is continuous anteriorly from the dorsal to the ventral coxal articulation and that there is a slender katepimeron I; Fig. 71. Antero-ventral view of thorax of *D. mendotae;* Fig. 72. Posterior view of thorax of *D. mendotae.* Note the internal furcae; Fig. 73. *D. mendotae;* Fig. 74. *D. mendotae.*



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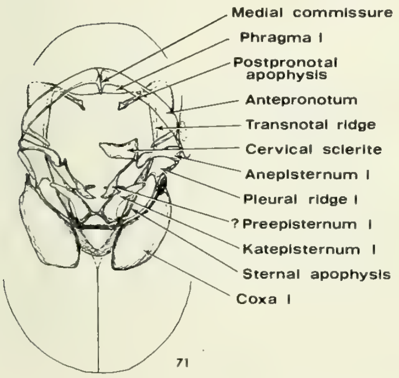
70 Sphaeromias



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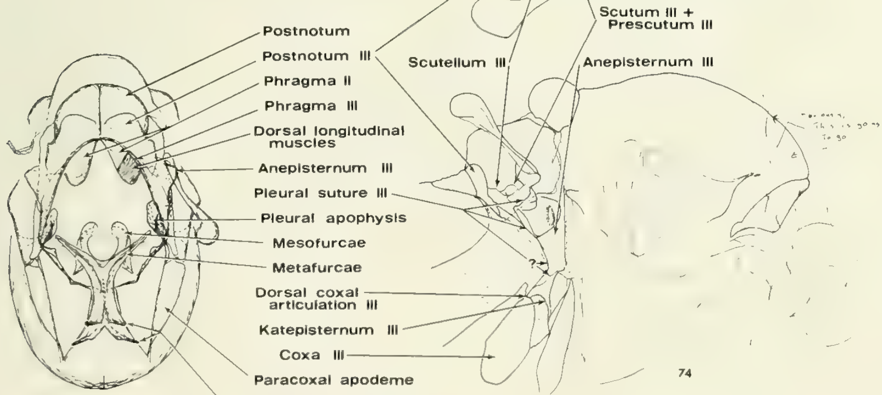

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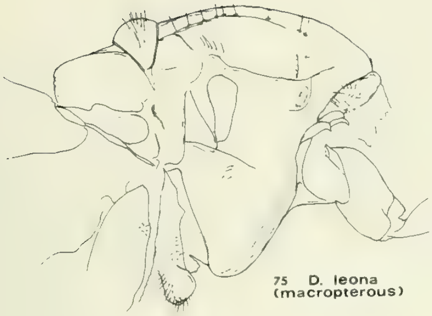
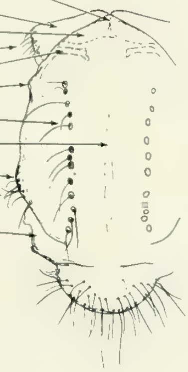
FIGS. 75-88. — Figs. 75-77. Self-explanatory. Note, however, the flattening of the scutum and scutellum and the rounded postero-dorsal border of the postnotum in the brachypterous *D. leona*. Also note the reduction in preepisternum II, the shortened anapleural suture, and the short setae just below the anapleural suture; Fig. 78. Portion of dorsum of thorax of *D. mendotae*. Figs. 79-82. Variation in arrangement of DCS in four specimens of *D. mendotae;* Figs. 83-85. Variation in shape of antepronotal notch in three specimens of *D. mendotae;* Fig. 86. Portion of dorsum of thorax of *D. leoniella*. Note "gaping" antepronotal notch; Fig. 87. Portion of dorsum of thorax of *D. leona,* macropterous form. The antepronotal notch is membranous medially; Fig. 88. As above, but brachypterous form. The antepronotal halves fuse medially.



75 D. leona (macropterous)



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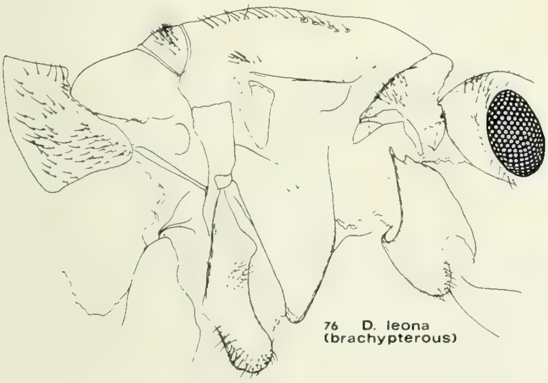
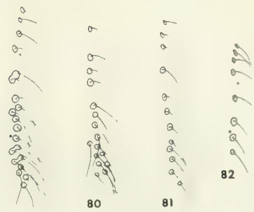


76 D. leona (brachypterous)



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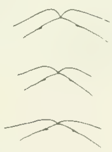

83 84 85

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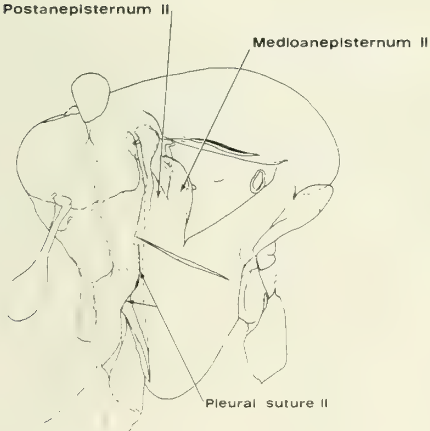
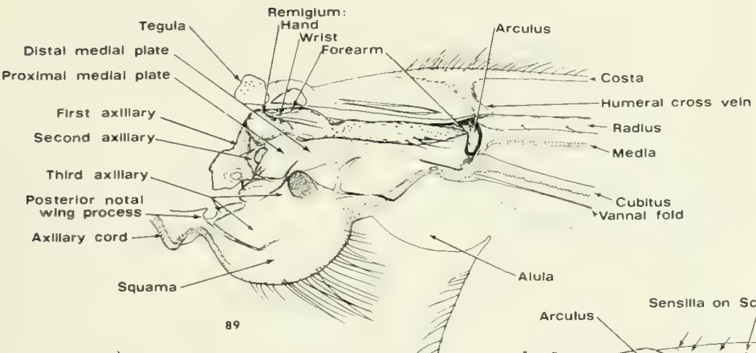


77 Lasiodiamesa

87

88

FIGS. 89-97. — Fig. 89. Base of wing of *D. mendotae;* Fig. 90. Distal end of remigium, arculus, etc., *D. mendotae.* The arrow heads point to the three anterior and one posterior large sensilla. The sensilla on Sc are on the ventral surface of the vein; Fig. 91. Junction of wing and mesothorax, *D. mendotae,* lateral view; Fig. 92. Details of first axillary sclerite of *D. mendotae;* Fig. 93. Wing of *D. mendotae;* Fig. 94-97. Series of hypothetical wings showing r-m moving proximally and R_4, R_5, and M_2 weakening and becoming nothing but vestiges.



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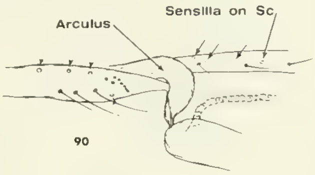

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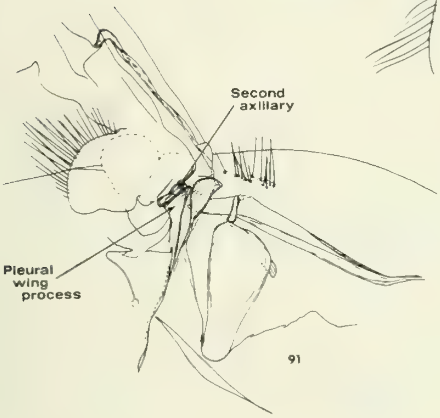

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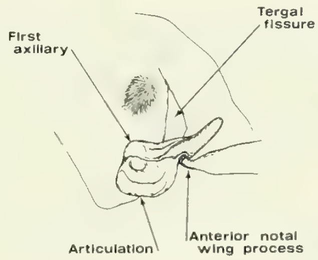

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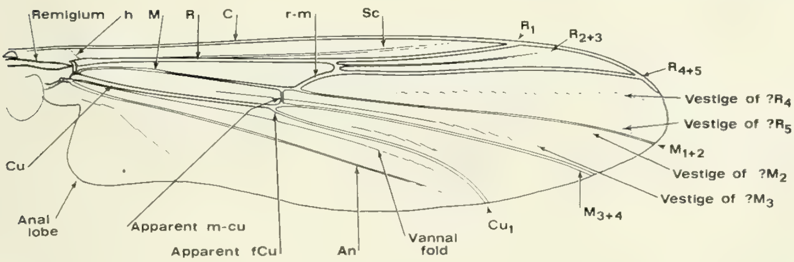

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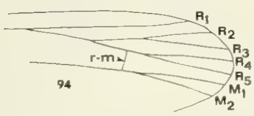

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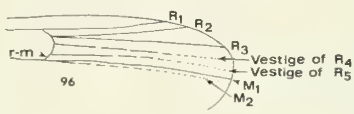

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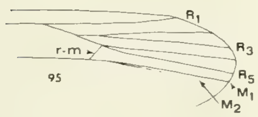

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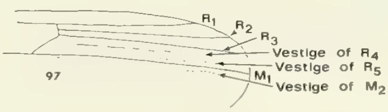

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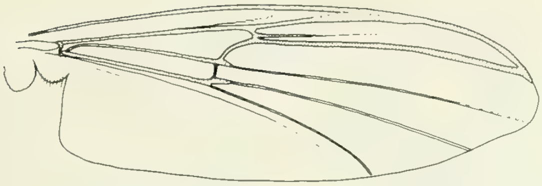
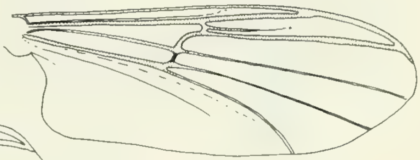
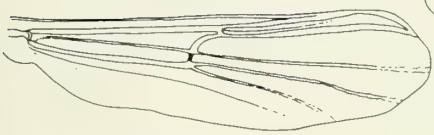
FIGS. 98-109. — Fig. 98. *D. nivicavernicola.* Note how the distal end of R_1 broadens and diffusely fuses with the costa; Figs. 99-101. Wings of *D. leona,* all to the same scale; Figs. 102-104. Self-explanatory; Fig. 105. Fore tibia of *D. haydaki,* showing slender apical spur with very sparse prickles and small basal sensillum; Fig. 106. Fore tibia of *D. leona.* Note that the apical spur is shortened and thickened, that the numerous prickles cover most of the spur, and that the sensillum is more distal than in Fig. 105; Fig. 107. Mid tibia of *D. leona,* showing one of the two apical spurs. Note extreme thickening of spur and the dense covering of prickles; Fig. 108. Spiniform setae on Tm_3 of P III of *D. haydaki.* Note how the spiniform setae are arranged more-or-less in pairs in two rows; Fig. 109. Apex of Ti III, showing short, stout setae on posterior surface, the polygon pattern, and the posterior comb.



98 D. nivicavernicola ♀

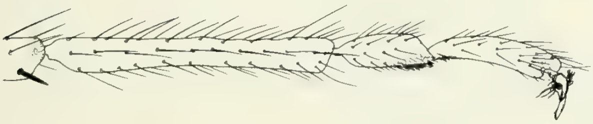


99 D. leona



100 D. leona

101 D. leona



102 P I, D. mendotae

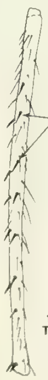
103 P I, D. leona

104 P II D. leona (brachypterous)

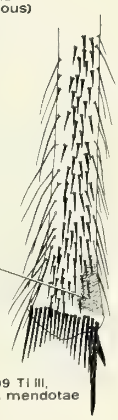
105 Ti I, D. haydaki

106 Ti I, D. leona

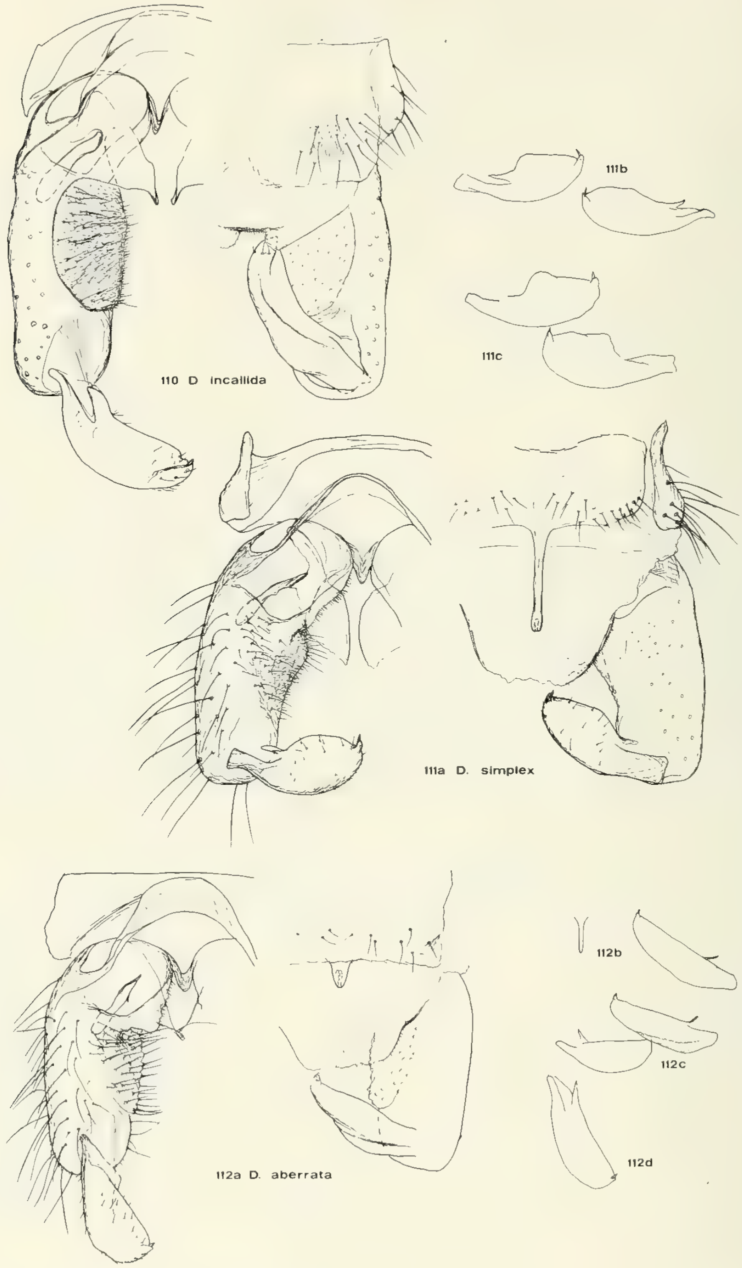
107 Ti II, D. leona



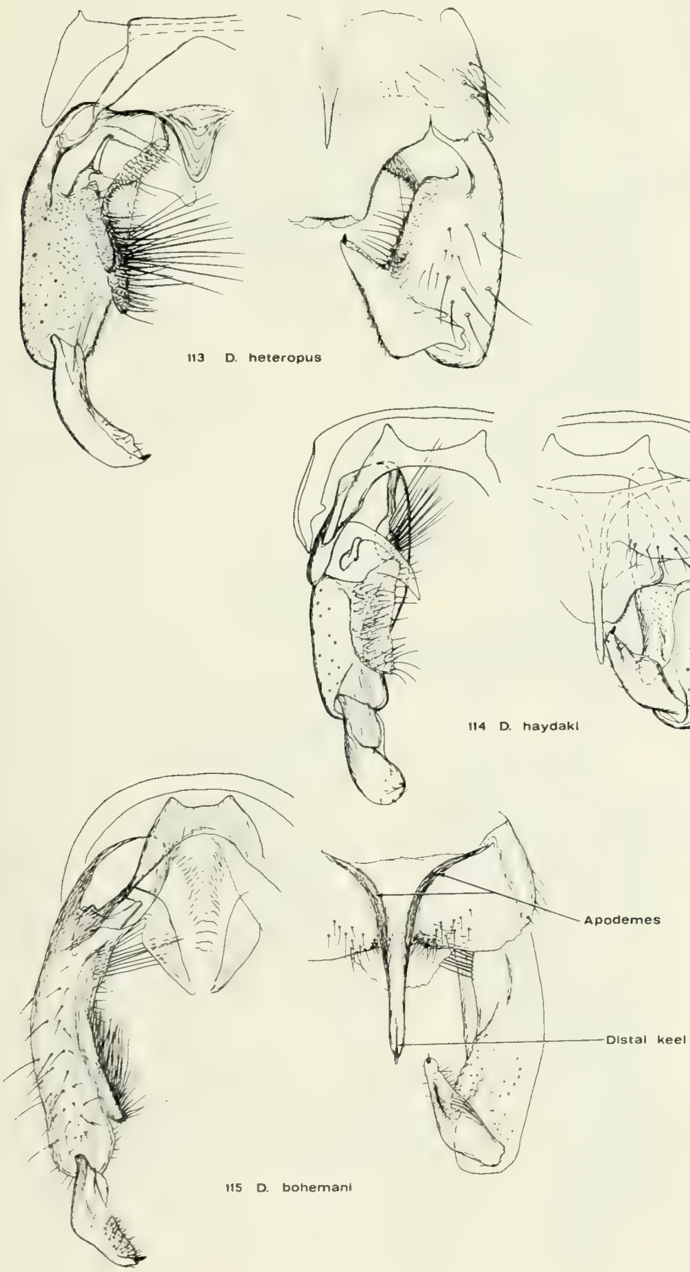
108 Tm_3



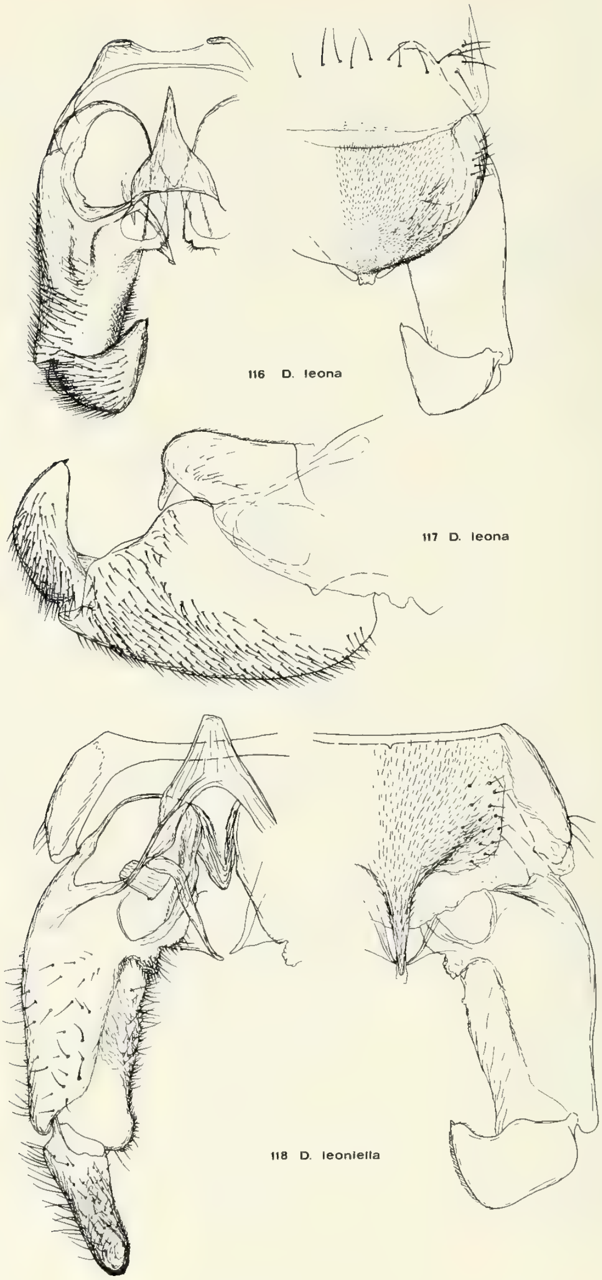
109 Ti III, D. mendotae



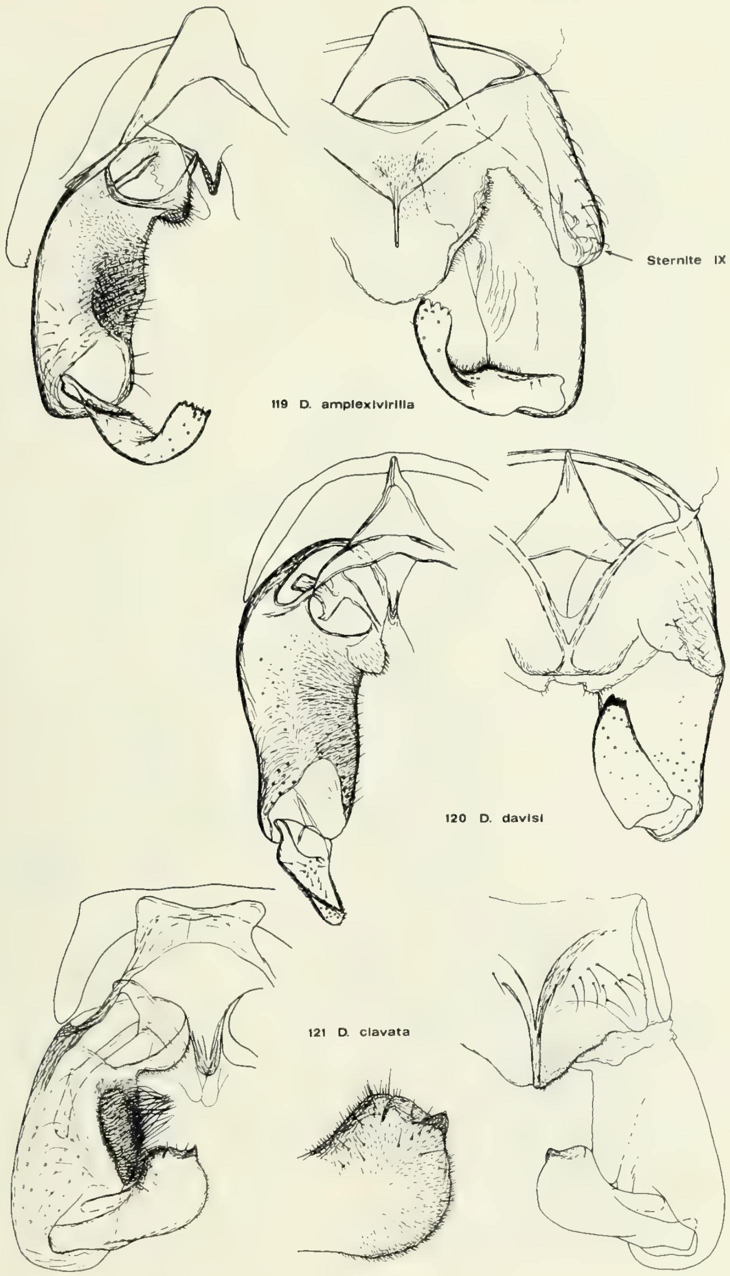
FIGS. 110-112. — Male hypopygia.



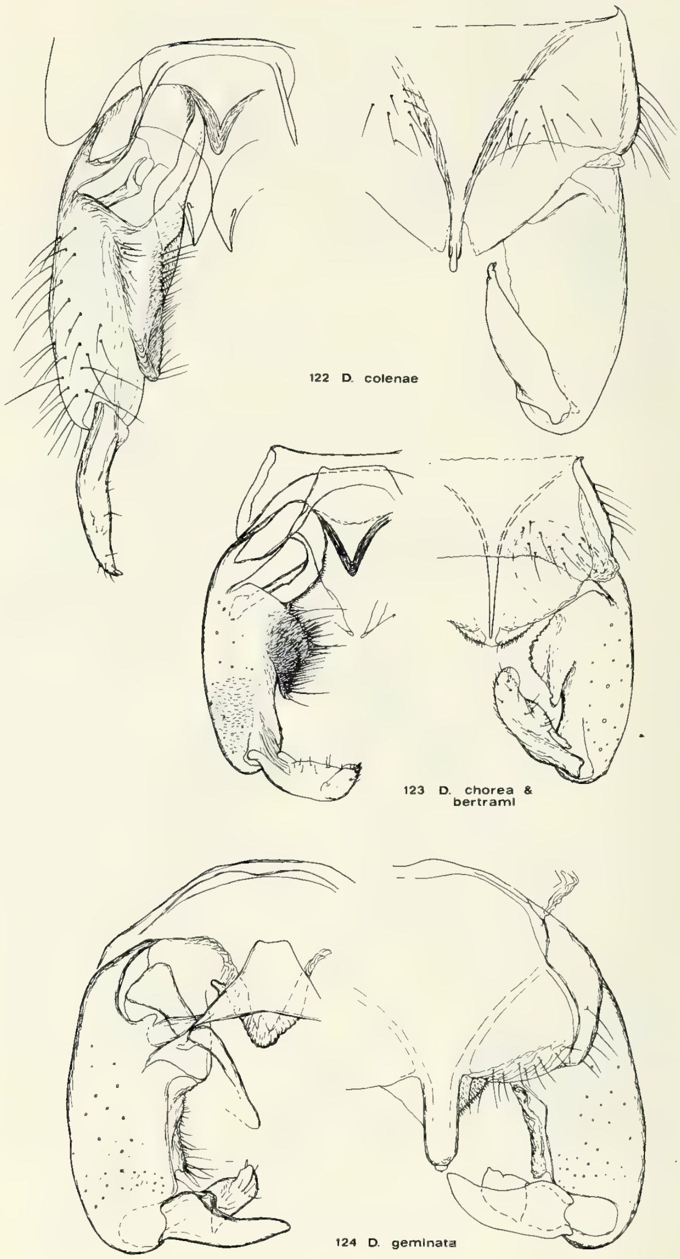
FIGS. 113-115. — Male hypopygia.



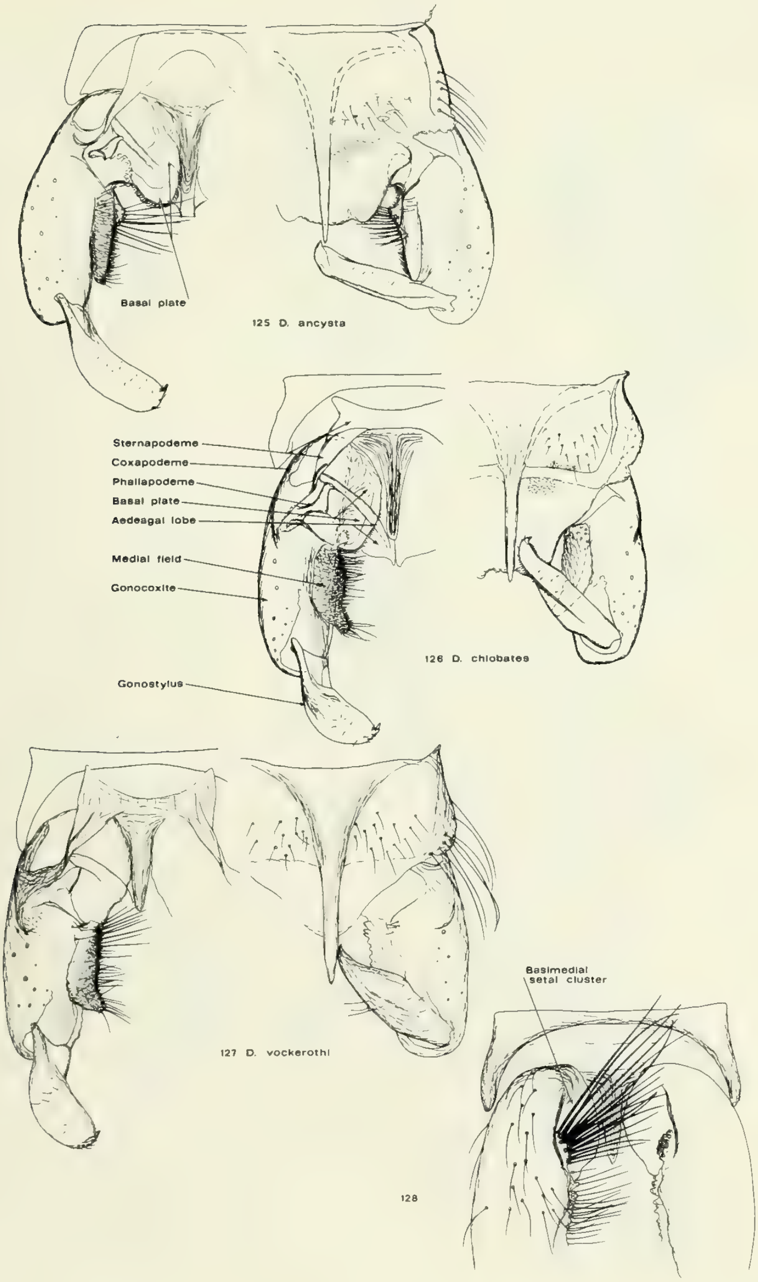
FIGS. 116-118. — Male hypopygia.



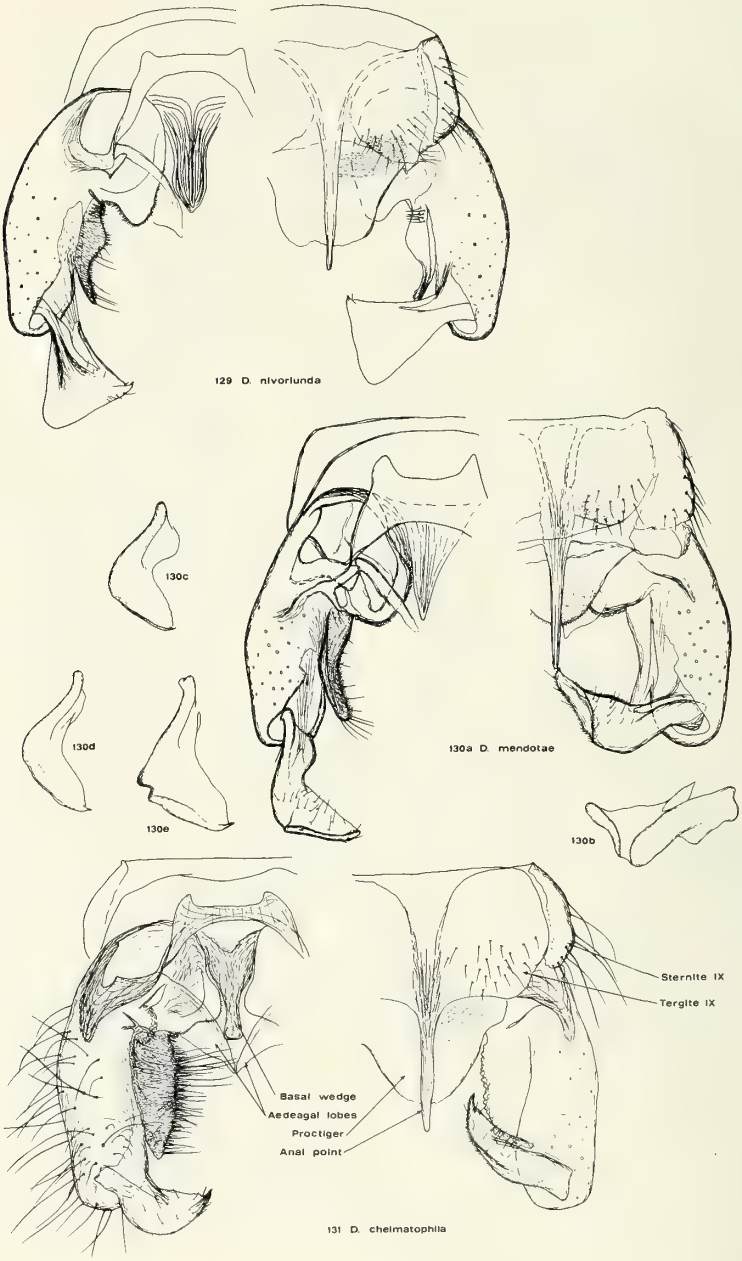
FIGS. 119-121. — Male hypopygia.



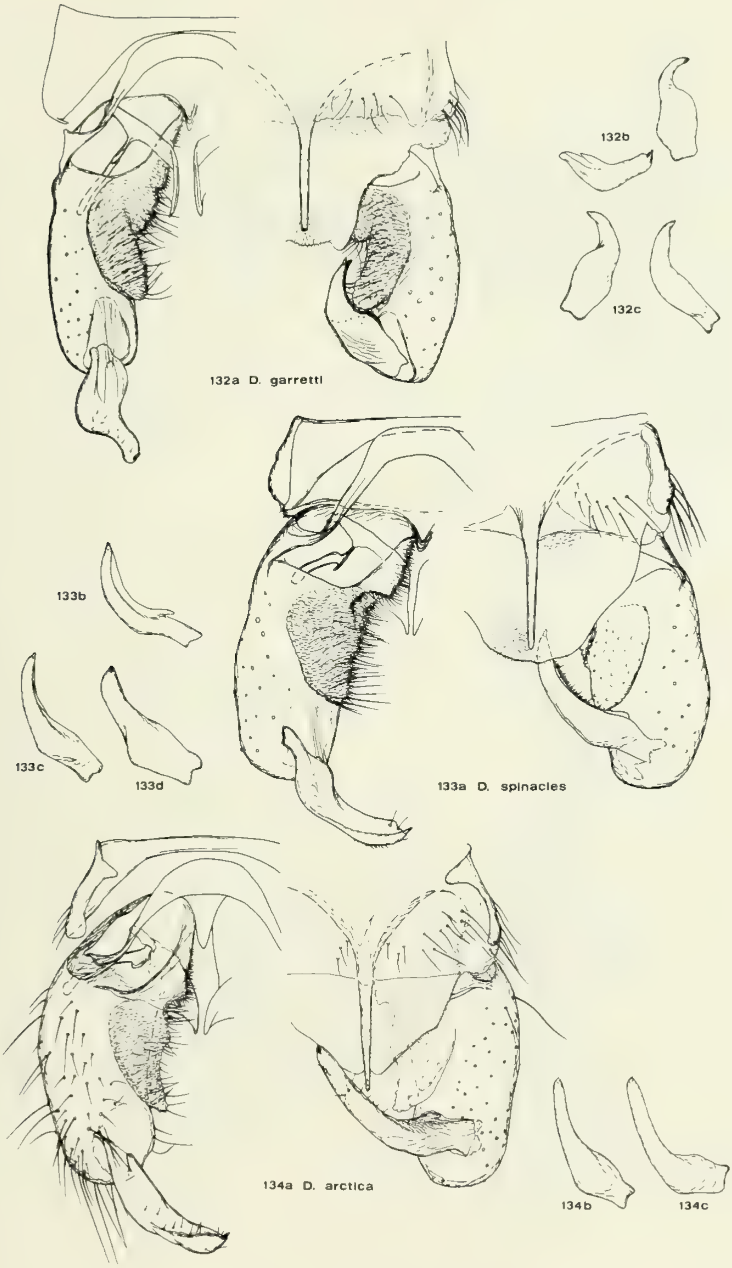
FIGS. 122-124. — Male hypopygia.



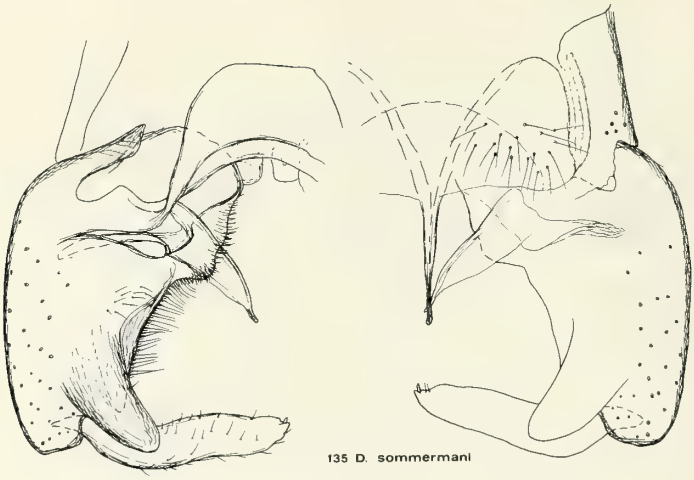
FIGS. 125-128. — Male hypopygia.



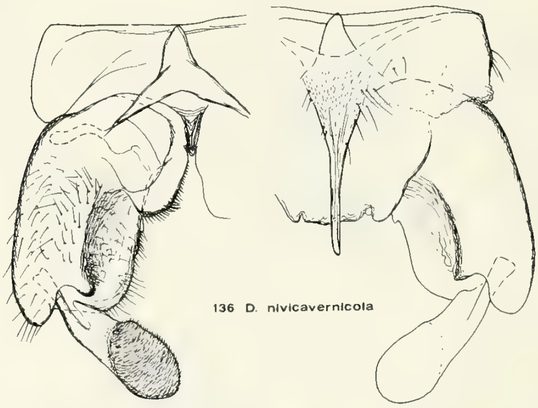
FIGS. 129-131. — Male hypopygia.



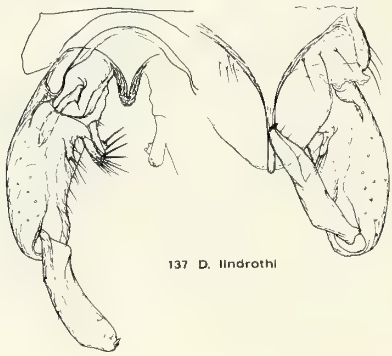
FIGS. 132-134. — Male hypopygia.



135 D. sommermani

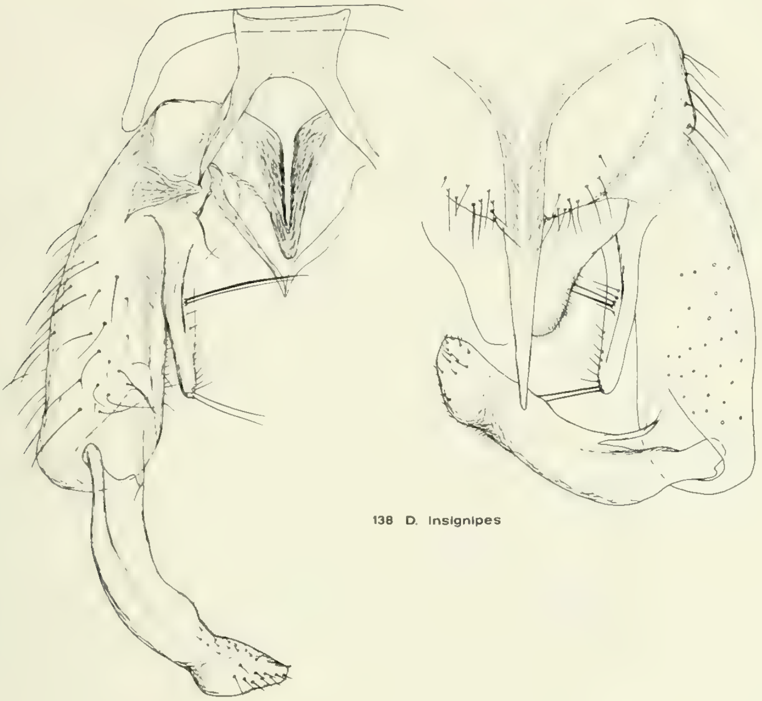


136 D. nivicavernicola

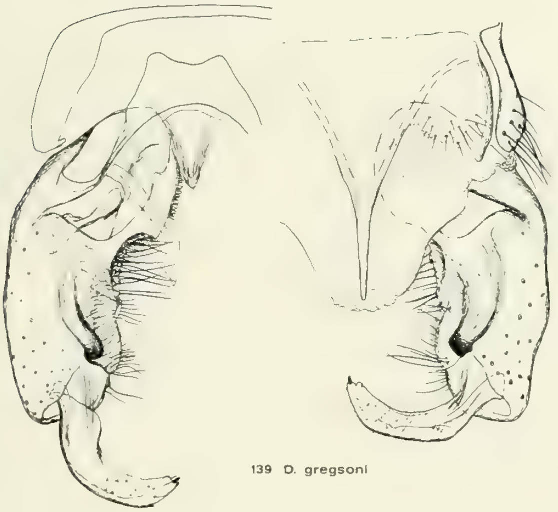


137 D. lindrothi

Figs. 135-137. — Male hypopygia.



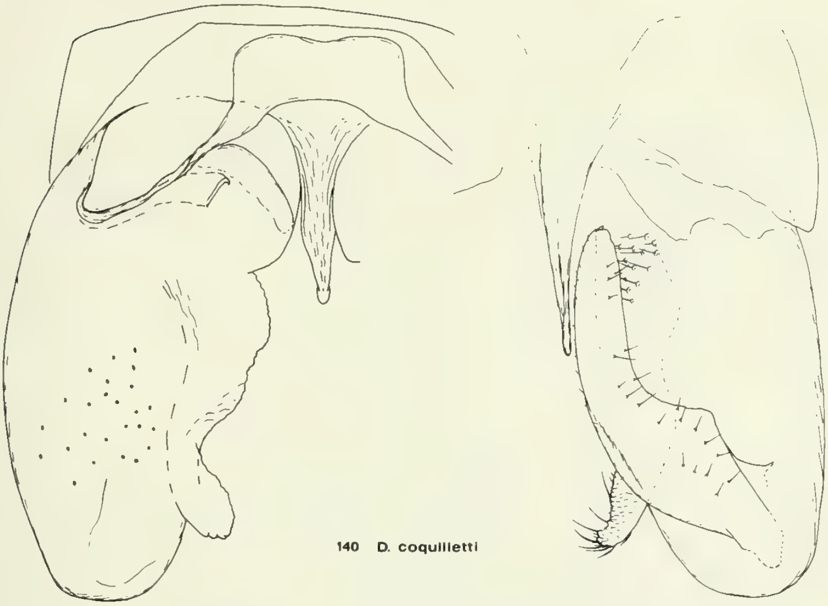
138 D. insignipes



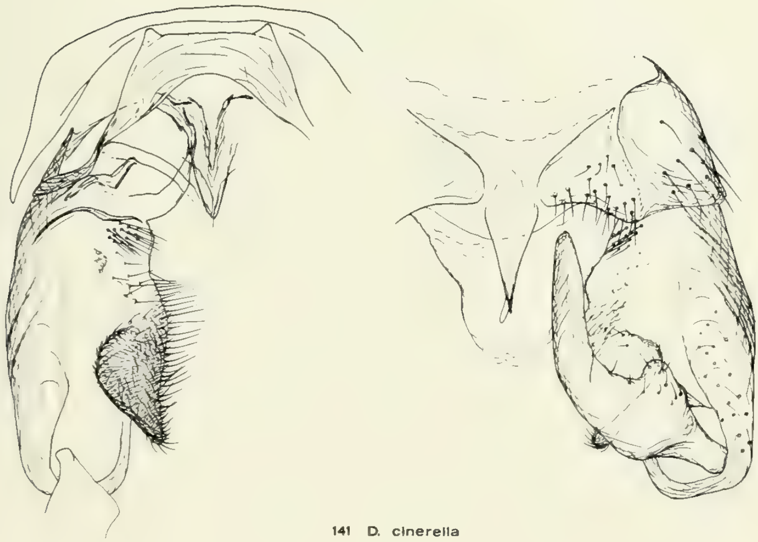
139 D. gregsoni

FIGS. 138-139. — Male hypopygia.

Figs. 140-141. — Male hypopygia.

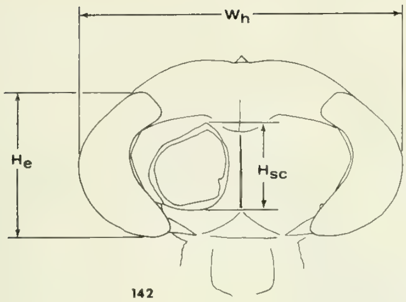


140 D. coquilletti



141 D. cinerella

FIGS. 142-147. — Figs. 142-144. Self-explanatory; Fig. 145. Costal projection beyond R_{4+5}; expressed numerically by dividing the length (L in figure) by the width of the vein; Fig. 146, 147. Explanation of LR, BV, and SV. In Fig. 147, LR would be lower, and BV and SV would be higher, than in Fig. 146.



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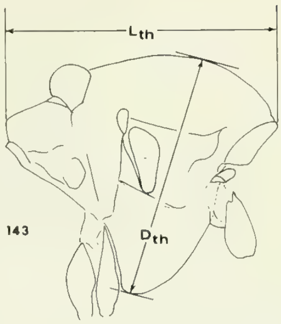

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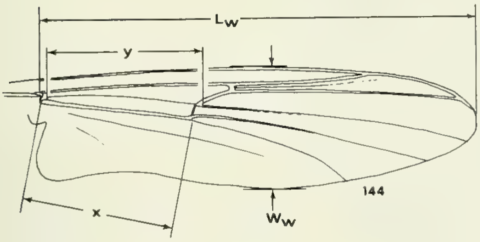

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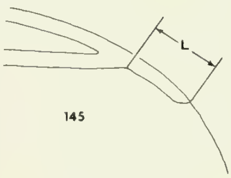
$VR = \frac{x}{y}$



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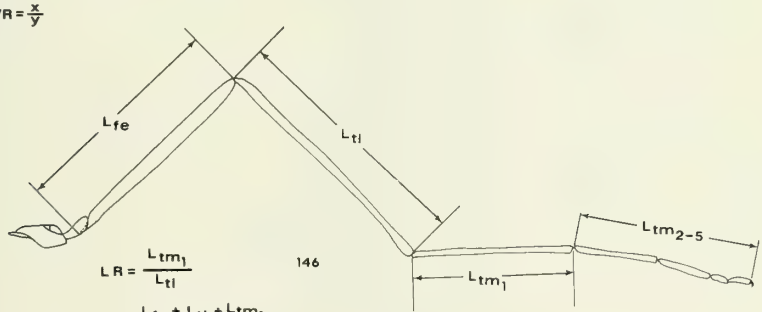

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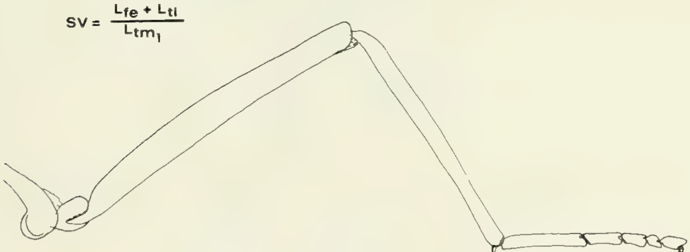
$LR = \frac{L_{tm_1}}{L_{ti}}$

$BV = \frac{L_{fe} + L_{ti} + L_{tm_1}}{L_{tm_{2-5}}}$

$SV = \frac{L_{fe} + L_{ti}}{L_{tm_1}}$



147 P II, D. leona (brachypterous)

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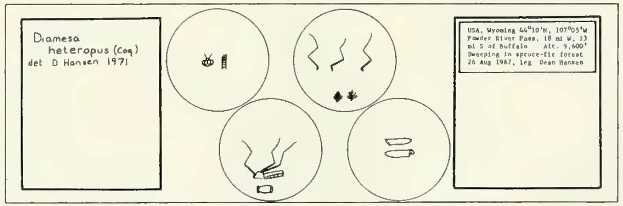

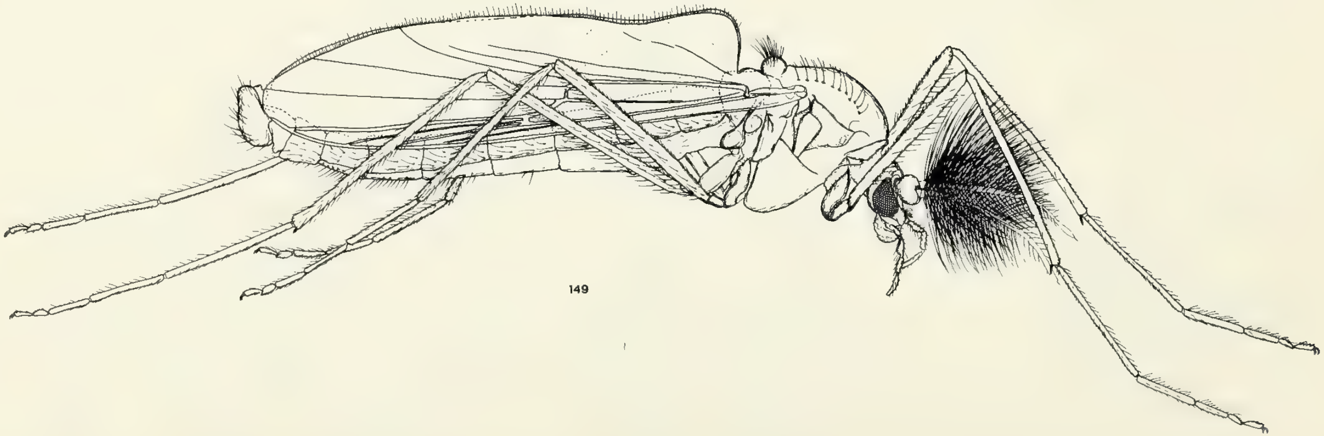

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FIGS. 148-149. — Fig. 148. Slide mount showing arrangement of parts of adult and label. The antennae should perhaps be mounted with the wings. This would make certain that the antennae could be observed with oil immersion. Fig. 149. Side view of *D. mendotae*.

Index

New species in **boldface,** synonyms in *italics.*

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THE STONEFLIES (PLECOPTERA) OF THE ROCKY MOUNTAINS

BY

RICHARD W. BAUMANN
ARDEN R. GAUFIN
REBECCA F. SURDICK

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THE STONEFLIES (PLECOPTERA) OF THE ROCKY MOUNTAINS

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INTRODUCTION

The first mention of stoneflies from the Rocky Mountains was by Hagen (1874, 1875) in his treatments of the neuropteroid insects collected by the Carpenter and Wheeler surveys in Colorado and New Mexico. Nathan Banks studied and described many specimens from the Rocky Mountains in the early 1900's many of which were collected by T. D. A. Cockerell. Needham and Claassen in their 1925 monograph of North American stoneflies added greatly to the knowledge of the Rocky Mountain fauna. Essig (1926) summarized the species recorded in the literature from the Rockies to 1925 and the Needham and Christensen (1927) study on the Logan River added interesting facts and gave common names to many western species. The above works dealt primarily with adults but in 1931 Claassen published his monograph on the nymphs.

In the mid-1900's numerous authors studied the Rocky Mountain stoneflies including: Castle, Dodds and Hisaw, Frison, Hanson, Jewett, Knowlton and Harmston, Neave and Ricker. During the last twenty

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years most of the research on Rocky Mountain Plecoptera has been carried out at the University of Utah by Arden R. Gaufin and students: Baumann, Cather, Hales, Jacobi, Jensen, Knight, Nebeker, Oblad, Richardson, Stark and Surdick.

Two major works Gaufin et al. (1966) and Gaufin et al. (1972) cover the species found in Utah and Montana respectively.

This monograph is a summary of the present knowledge on the systematics and distribution of Rocky Mountain stoneflies (Plecoptera). It also provides newly revised keys to all species in as many life stages as possible. Hopefully this will become a useful tool to the many persons presently conducting research in flowing water ecosystems in the Rocky Mountains and will also stimulate interest in the distribution of stoneflies in western North America.

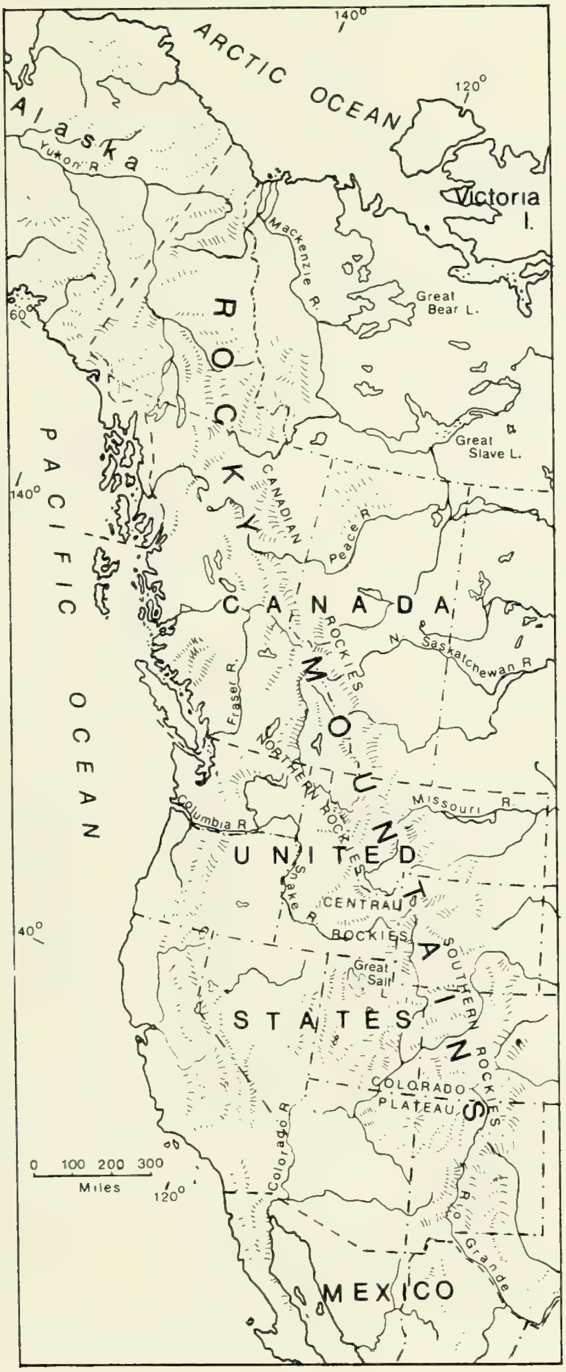
The systematic arrangement followed is that of Illies (1966) and Zwick (1973) with modifications based on the critique of Steyskel in Baumann (1976).

Study Area

In an effort to explain distribution patterns of stoneflies in the Rocky Mountain region Nebeker and Gaufin (1967a) and Gaufin in Baumann (1976) divided the area into two regions: Northern Rocky Mountains and Southern Rocky Mountains. This division was an oversimplification, so for this paper we have decided to use a more involved separation which includes four basic divisions: Canadian Rockies, Northern Rockies, Central Rockies and Southern Rockies. A detailed description of these four regions as condensed from Fairchild (1966) follows (Map).

> The Canadian Rockies extend northwest-south-eastward across the Yukon Territory and the extreme western part of the Northwest Territories of Canada and, in the south, are on the British Columbia and Alberta borderline. The Canadian Rockies from north to south include the Richardson, Peel, Fortymile, Mackenzie, Pelly, Stikine, Telegraph, Caribou, Monashee, Selkirk, and Purcell Ranges.
>
> The Northern Rockies of the United States are along the Canadian borderline in Idaho and western Montana and include numerous ranges divided by three north-south-running trenches called the Rocky Mountain, the Purcell and Selkirk trenches. East of the Rocky Mountain trench are the Lewis, MacDonald and Galton ranges; between the Rocky Mountain and Purcell trenches are the

Map. — Map of the Rocky Mountains.


ARCTIC OCEAN
Alaska
Yukon R.
Victoria I.
Mackenzie R.
Great Bear L.
Great Slave L.
ROCKY MOUNTAINS
CANADIAN
Peace R.
PACIFIC OCEAN
CANADA
ROCKIES
N. Saskatchewan R.
Fraser R.
NORTHERN ROCKIES
Missouri R.
Columbia R.
UNITED STATES
Snake R.
CENTRAL ROCKIES
Great Salt L.
SOUTHERN ROCKIES
COLORADO PLATEAU
Colorado R.
Rio Grande
MEXICO
0 100 200 300
Miles
140°
120°
60°
40°

Mission, Flathead, McGillivray, Yank, and Mayee ranges. The Purcell and Selkirk trenches enclose the Nelson, Cabinet, Coeur d'Alene, Bitterroot, Pend Oreille, Clearwater, Roseland, Bonnington and Selkirk ranges and west of the Selkirk trench are the Coville, Christina and Columbia mountains.

The Central Rocky section begins south of the Yellowstone River and extends from southern Montana, across Wyoming, into Northern Colorado and Utah. These ranges, from north to south, are the Big Horn, Laramie, Bridger, Owl Creek, Shoshone, Medicine Bow, Absaroka and Wind River. The Wyoming Basin, which offers a broad pass to the west, is included in this section and so are the Uintah, Teton, Gros Ventre, Hoback, Snake River, Wyoming, Salt River, Idaho and Wasatch Mountains.

The highest peaks and greatest development of the Rocky Mountains occur in the Southern Rockies, which extend from northern Colorado to southern New Mexico. They consist of two parallel groups of ranges. On the east is the Front Range, a continuation of the Laramie Range of Wyoming, rising abruptly from a plain just west of Denver and Colorado Springs, Colorado. The more westerly of the two parallel ranges is the Park Range beginning at the north with the Sierra Madre mountains of Wyoming just west of the Medicine Bow Mountains and continuing southward to the vicinity of Leadville, Colorado. The Park Range is continued by the mighty Sawatch Range, which includes some of the highest peaks in the Rockies. The Front and, Park-Sawatch ranges are separated by three plateau-like basins called parks: North, Middle and South Park. Below Salida the Sawatch Range is continued by the Sangre de Cristo Range into New Mexico. Westward of the Sangre de Cristo Range is the great San Luis Valley, formed by the upper Rio Grande. The San Juan mountains extend from the west side of this valley in New Mexico in a northwesterly direction toward the Colorado Plateau.

While the Rocky Mountains are usually said to end in northern New Mexico, geographically they extend southward into Mexico. In central and southern New Mexico and south of the Sangre de Cristo Range, the mountains diminish in height, are more disconnected, and have isolated volcanic areas and peaks, many short, block-faulted ranges, and intermountain basins. They are known as the Mexican Highlands and Trans Pecos region. In a general way the Sacramento, Guadalupe, San Andreas, Organ and other related mountains extend southward toward the Sierra Madre system of Mexico.

For this study the Rocky Mountains are considered to end at the Yukon border in the north and the Mexican border in the south. The east-west divisions are not always as easy to delineate but will be discussed under each of the four major divisions.

The Canadian Rockies are difficult to separate from the Cascade Range in southern British Columbia. This results in the fact that this area serves as a distribution tract that produces a mixing of typical Rocky Mountain and Cascade faunal elements. Several large rivers like the Columbia and Fraser actually begin in the Rocky Mountains but most of their drainage systems are in the Cascade and Coast ranges. The eastern slope of the Canadian Rockies is easier to delineate because it borders the Great Plains but here again some eastern species could reach the Rocky Mountains via large rivers which drain eastward like the Peace and Saskatchewan. However, most stonefly species found in the headwaters of these rivers are typical Rocky Mountain species; thus the upper Peace River around Grande Prairie and the upper Saskatchewan River in southwestern Saskatchewan are included here.

The Northern Rockies include much of eastern Washington as well as the northeastern corner of Oregon. The southern border in Idaho is the Snake River Plain. This division line continues north eastward as noted following the Yellowstone River to the Montana-Dakotas border.

The broadest east-west expanse is spanned by the Central Rockies. From a faunal standpoint they extend from the Great Basin ranges of eastern Nevada to the Black Hills of South Dakota. Their southern border runs just north of Las Vegas in Nevada, along the southern fringe of the Wasatch Mountains in Utah and a short distance south of the Wyoming-Colorado border.

Probably the most interesting section of the Rockies, as it relates to distribution patterns, is the Southern Rocky Mountain region. It contains many isolated mountain ranges that are separated by broad expanses of desert and very harsh environments for aquatic organisms. It also contains the most abrupt variations in elevation. These factors coupled with the close proximity of the Mexican Highlands produce continuous surprises to those collectors that are willing to spend the time and effort needed to obtain specimens.

The Southern Rockies include the Spring Range in southern Nevada, the mountains of southern Utah, including the La Sal and Abajo ranges along the eastern border, all the mountains of Arizona and New Mexico and most of the mountains in Colorado. It seems logical that the mountains of West Texas should belong in this division but to date no confirmed records of stonefly species are available from the Davis, Van

Horn, Guadalupe and Chisos mountains. One Rocky Mountain species has, however, been collected from Palo Duro Canyon near Amarillo in the Texas panhandle (Stewart et al., 1974).

Distribution patterns are given under each species according to the above geographical boundaries. Data about each species are divided into three categories: Geographic range, which is a generalized statement about distribution; Distribution, which is a detailed listing of confirmed collecting sites usually given as counties in the respective states of the United States and mountain ranges or drainages in Canada, with more detailed data being provided for rare or seldom collected species; Discussion, which can contain any kind of miscellaneous data but often includes specific ecological information and emergence data.

Acknowledgments

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Species List of Rocky Mountain Stoneflies

This list follows the systematic arrangement in Illies (1966) as revised by Zwick (1973) and Steyskal in Baumann (1976). Species marked with an asterisk * are reported from the area included in the Rocky Mountains but the records are questionable and were not confirmed as part of this study.

Order PLECOPTERA

Suborder ARCTOPERLARIA

Group Euholognatha

Family **Nemouridae**

Subfamily Amphinemurinae

Genus *Amphinemura*

A. apache Baumann and Gaufin 1972
A. banksi Baumann and Gaufin 1972
A. linda (Ricker) 1952
A. mogollonica Baumann and Gaufin 1972
A. venusta (Banks) 1911

Genus *Lednia*

L. tumana (Ricker) 1952

Genus *Malenka*

M. californica (Claassen) 1923
M. coloradensis (Banks) 1897
M. flexura (Claassen) 1923
M. tina (Ricker) 1952

Subfamily Nemourinae

Genus *Nemoura*

N. arctica Esben-Petersen 1910

Genus *Podmosta*

P. decepta (Frison) 1942
P. delicatula (Claassen) 1923

Genus *Prostoia*

P. besametsa (Ricker) 1952

Genus *Soyedina*

S. potteri (Baumann and Gaufin) 1971

Genus *Visoka*

V. cataractae (Neave) 1933

Genus *Zapada*

Z. cinctipes (Banks) 1897
Z. columbiana (Claassen) 1923
Z. cordillera (Baumann and Gaufin) 1971
Z. frigida (Claassen) 1923
Z. glacier (Baumann and Gaufin) 1971
Z. haysi (Ricker) 1952
Z. oregonensis (Claassen) 1923

Family **Taeniopterygidae**

Subfamily Brachypterinae

Genus *Doddsia*

D. occidentalis (Needham and Claassen) 1925

Genus *Oemopteryx*

O. fosketti (Ricker) 1964

Genus *Taenionema*

T. nigripenne (Banks) 1918
T. pacificum (Banks) 1900
T. pallidum (Banks) 1902

Subfamily Taeniopteryginae

Genus *Taeniopteryx*

T. nivalis (Fitch) 1847

Family **Capniidae**

Genus *Bolshecapnia*

B. gregsoni (Ricker) 1965
B. milami (Nebeker and Gaufin) 1967
B. sasquatchi (Ricker) 1965
B. spenceri (Ricker) 1965

Genus *Capnia*

C. barbata Frison 1944
C. californica Claassen 1924
C. cheama Ricker 1965
C. coloradensis Claassen 1937
C. confusa Claassen 1936
C. cygna Jewett 1954
C. decepta (Banks) 1897
C. fibula Claassen 1924

C. gracilaria Claassen 1924
C. lineata Hanson 1943
C. nana Claassen 1924
C. nedia Nebeker and Gaufin 1966
C. petila Jewett 1954
C. sextuberculata Jewett 1954
C. uintahi Gaufin 1964
C. utahensis Gaufin and Jewett 1963
C. venosa (Banks) 1900
C. vernalis Newport 1848
C. wanica Frison 1944

Genus *Eucapnopsis*

E. brevicauda (Claassen) 1924

Genus *Isocapnia*

I. crinita (Needham and Claassen) 1925
I. grandis (Banks) 1908
I. hyalita Ricker 1959
I. integra Hanson 1943
I. missourii Ricker 1959
I. vedderensis (Ricker) 1943

Genus *Mesocapnia*

M. arizonensis (Baumann and Gaufin) 1969
M. frisoni (Baumann and Gaufin) 1970
M. lapwae (Baumann and Gaufin) 1970
M. oenone (Neave) 1929
M. werneri (Baumann and Gaufin) 1970

Genus *Paracapnia*

P. angulata Hanson 1961

Genus *Utacapnia*

U. columbiana (Claassen) 1924
U. distincta (Frison) 1937
U. lemoniana (Nebeker and Gaufin) 1965
U. logana (Nebeker and Gaufin) 1965
U. poda (Nebeker and Gaufin) 1965
U. trava (Nebeker and Gaufin) 1965

Family **Leuctridae**

Subfamily Leuctrinae

Genus *Despaxia*

D. augusta (Banks) 1907

Genus *Paraleuctra*

P. forcipata (Frison) 1937
P. jewetti Nebeker and Gaufin 1966

P. occidentalis (Banks) 1907
P. purcellana (Neave) 1934
P. rickeri Nebeker and Gaufin 1966
P. vershina Gaufin and Ricker 1974

Genus *Perlomyia*

P. collaris Banks 1906
P. utahensis Needham and Claassen 1925

Subfamily Megaleuctrinae

Genus *Megaleuctra*

M. kincaidi Frison 1934
M. stigmata (Banks) 1900

Group Systellognatha

Family **Peltoperlidae**

Genus *Yoraperla*

Y. brevis (Banks) 1907
Y. mariana (Ricker) 1943

Family **Pteronarcyidae**

Genus *Pteronarcella*

P. badia (Hagen) 1874
P. regularis (Hagen) 1874

Genus *Pteronarcys*

P. californica Newport 1848
P. dorsata (Say) 1823
P. princeps Banks 1907

Family **Perlodidae**

Subfamily Isoperlinae

Genus *Isoperla*

I. bilineata (Say) 1823
I. ebria (Hagen) 1874
I. fulva Claassen 1937
I. fusca Needham and Claassen 1925
I. longiseta Banks 1906
I. mormona Banks 1920
I. patricia Frison 1942
I. petersoni Needham and Christenson 1927
I. phalerata (Smith) 1917
I. pinta Frison 1937
I. quinquepunctata (Banks) 1902
* *I. sobria* (Hagen) 1874

I. sordida (Banks) 1906
I. trictura Hoppe 1938

Subfamily Perlodinae

Genus *Arcynopteryx*

A. compacta (MacLachlan) 1872

Genus *Cultus*

C. aestivalis (Needham and Claassen) 1925
C. pilatus (Frison) 1942
C. tostonus Ricker 1952

Genus *Diura*

D. knowltoni (Frison) 1937

Genus *Isogenoides*

I. colubrinus (Hagen) 1874
I. elongatus (Hagen) 1874
I. zionensis (Hanson) 1949

Genus *Kogotus*

K. modestus (Banks) 1908
K. nonus (Needham and Claassen) 1925

Genus *Megarcys*

M. signata (Hagen) 1874
M. subtruncata (Needham and Claassen) 1925
M. watertoni (Ricker) 1952

Genus *Perlinodes*

P. aurea (Smith) 1917

Genus *Pictetiella*

P. expansa (Banks) 1920

Genus *Setvena*

S. bradleyi (Smith) 1917

Genus *Skwala*

S. curvata (Hanson) 1942
S. parallela (Frison) 1936

Family **Perlidae**

Subfamily Acroneuriinae

Genus *Acroneuria*

A. abnormis (Newman) 1838
* *A. internata* (Walker) 1852

Genus *Calineuria*

C. californica (Banks) 1905

Genus *Doroneuria*

D. baumanni Stark and Gaufin 1974
D. theodora (Needham and Claassen) 1922

Genus *Hesperoperla*

H. pacifica (Banks) 1938

Genus *Perlesta*

P. placida (Hagen) 1861

Subfamily Perlinae

Genus *Claassenia*

C. sabulosa (Banks) 1900

Genus *Neoperla*

N. clymene (Newman) 1839

Family **Chloroperlidae**

Subfamily Chloroperlinae

Genus *Alloperla*

A. delicata Frison 1935
A. medveda Ricker 1952
A. pilosa Needham and Claassen 1925
A. serrata Needham and Claassen 1925
A. severa (Hagen) 1861

Genus *Hastaperla*

* *H. brevis* (Banks) 1895

Genus *Neaviperla*

N. forcipata (Neave) 1929

Genus *Suwallia*

S. autumna (Hoppe) 1938
S. lineosa (Banks) 1918
S. pallidula (Banks) 1904

Genus *Sweltsa*

S. albertensis (Needham and Claassen) 1925
S. borealis (Banks) 1895
S. coloradensis (Banks) 1898
* *S. exquisita* (Frison) 1935
S. fidelis (Banks) 1920
* *S. fraterna* (Banks) 1935
S. gaufini Baumann 1973
S. lamba (Needham and Claassen) 1925
* *S. occidens* (Frison) 1937
* *S. pacifica* (Banks) 1895
S. revelstoka (Jewett) 1955

Genus *Triznaka*

T. diversa (Frison) 1935
T. pintada (Ricker) 1952
T. signata (Banks) 1895

Subfamily Paraperlinae

Genus *Kathroperla*

K. perdita Banks 1920

Genus *Paraperla*

P. frontalis (Banks) 1902
P. wilsoni Ricker 1965

Genus *Utaperla*

U. sopladora Ricker 1952

KEY TO THE FAMILIES

Males and Females

1. Paraglossae and glossae of about equal length (fig. 7) 2
   Paraglossae much longer than glossae (fig. 2) 7
2. Anterior abdominal sterna with branched gill remnants (fig. 13); anal area of forewings with two or more full rows of crossveins (fig. 54) .... **Pteronarcyidae**
   Abdominal sterna without branched gill remnants; anal area of forewings without crossveins or with only one row 3
3. Ocelli two; form roach-like (fig. 365); ten or more costal crossveins in forewings .... **Peltoperlidae**
   Ocelli three; form elongate (fig. 304); less than ten costal crossveins in forewings, except in *Isocapnia* which may have ten or more 4
4. Second tarsal segment much shorter than first (fig. 19) 5
   Second tarsal segment at least as long as first (fig. 20) .... **Taeniopterygidae**
5. General form stout and rather robust; X-shaped pattern present in forewings at cord (fig. 62) .... **Nemouridae**
   General form thin and elongate (fig. 304), except *Megaleuctra* which is quite stout; X-shaped pattern absent from forewings at cord (fig. 61) 6
6. Wings lying flat at rest; cerci with four or more segments (figs. 163, 304) .... **Capniidae**
   Wings slightly rolled when at rest; cerci one segmented (figs. 323, 325) .... **Leuctridae**
7. Branched gill remnants present at lower angles of thorax .... **Perlidae**
   Branched gill remnants absent from lower angles of thorax 8
8. External gill remnants entirely lacking; second anal vein of forewing not forked or forked beyond anal cell, except in *Kathroperla* which has the fork at margin of cell or included in it (fig. 56) .... **Chloroperlidae**
   External gill remnants simple or absent; fork of second anal vein of forewing included in anal cell, so that its branches leave cell separately (fig. 52) .... **Perlodidae**

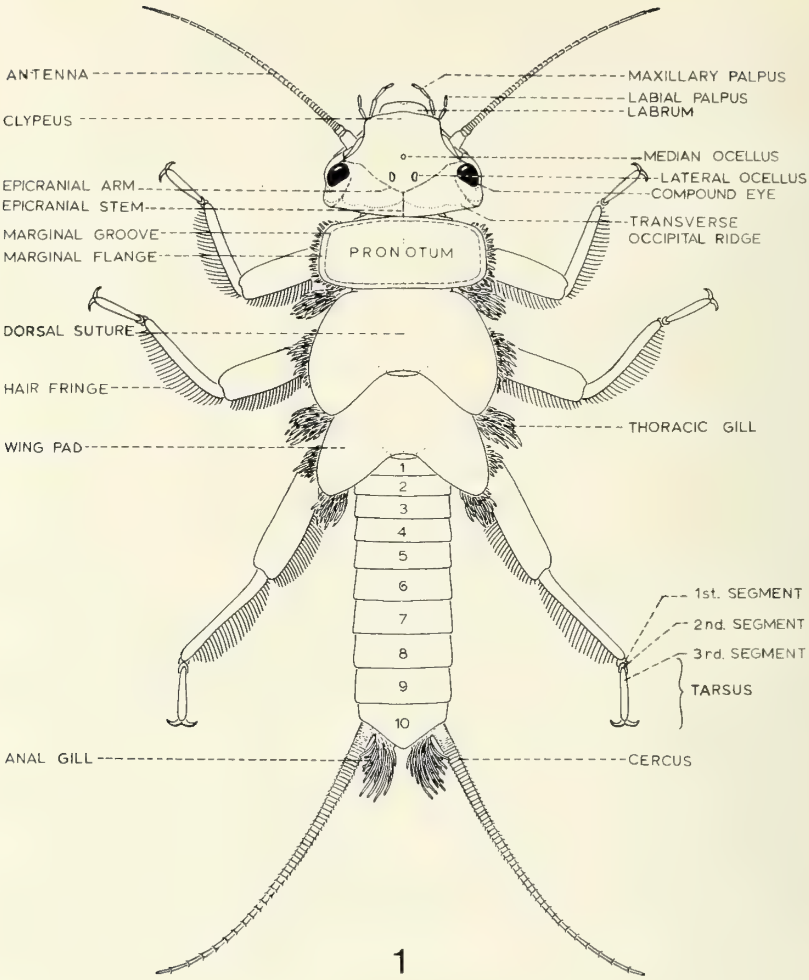
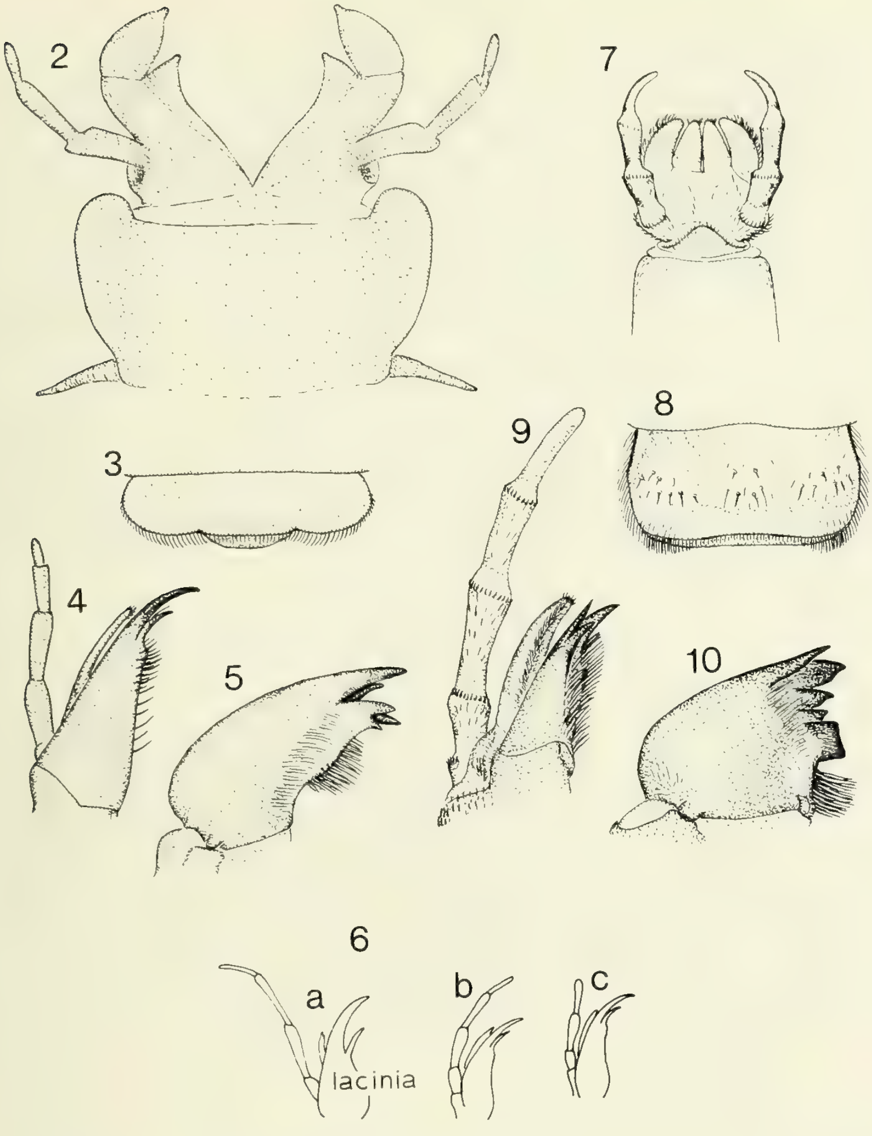


FIGURE 1. — Nymphal diagram, dorsal view.

Mature Nymphs

1. Paraglossae and glossae of equal length (fig. 7) 2
   Paraglossae much longer than glossae (fig. 2) 7
2. Anterior abdominal sterna with branched gills (fig. 13) .... **Pteronarcyidae**
   Abdominal sterna without branched gills 3
3. Ocelli two; form roach-like (fig. 362); thoracic sterna overlapping next segment .... **Peltoperlidae**
   Ocelli three; form elongate (fig. 162); thoracic sterna not overlapping next segment 4



FIGURES 2-10. — *Isogenoides zionensis* Hanson: 2, labium, nymph; 3, labrum, nymph; 4, maxilla, nymph; 5, mandible, nymph. 6, nymphal maxillae: a, *Cultus aestivalis* (Needham and Claassen); b, *Diura knowltoni* (Frison); c, *Isogenoides elongatus* (Hagen). *Pteronarcys californica* Newport: 7, labium, nymph; 8, labrum, nymph; 9, maxilla, nymph; 10, mandible, nymph.

4. Second tarsal segment much shorter than first (fig. 19) 5
   Second tarsal segment at least as long as first (fig. 20) .... **Taeniopterygidae**
5. Form stout with hindwing pads strongly divergent from body axis (fig. 63) .... **Nemouridae**
   Form elongate and cylindrical with hindwing pads nearly parallel (fig. 162) 6
6. Notch on inner margins of hindwing pads located on anterior third; abdominal segments one to nine divided by a membranous fold laterally (fig. 11) .... **Capniidae**
   Notch on inner margins of hindwing pad located on posterior third; at most only the first seven abdominal segments divided by a membranous fold (fig. 12) .... **Leuctridae**
7. Branched gills present at lower angles of thorax; apex of glossae rounded .... **Perlidae**
   Branched gills absent from thorax; apex of glossae pointed 8
8. Dorsal surface usually pigmented in distinct pattern; cerci as long as or longer than abdomen; hindwing pads of mature nymphs diverging from body axis (figs. 16, 17) .... **Perlodidae**
   Dorsal surface concolorous; cerci not more than three fourths as long as abdomen; hindwing pads nearly parallel to body axis, except in *Kathroperla* which has an elongate head (figs. 15, 478) .... **Chloroperlidae**

Order PLECOPTERA

Group Euholognatha

Family **Nemouridae**

The members of this family are the most common stoneflies in most habitats in the Rocky Mountains. The nymphs are small and stout bodied with numerous spines and hairs on the dorsal surface and appendages (fig. 63). The adults are easily recognized by the distinctive nemourid "X" in the forewings at the cord (figs. 140-143).

This family is very important from an ecological standpoint because they are often the dominant primary consumers in flowing water ecosystems. They are detritivores and often act as shredders of heterotrophic material, such as leaves, that enter the ecosystem from outside.

FIGURES 11-22. — 11, *Capnia* sp. nymph, abdomen, lateral view; 12, *Paraleuctra* sp. nymph, abdomen, lateral view; 13, *Pteronarcys californica* Newport, nymph; 14, *Pteronarcella badia* (Hagen), nymph; 15, Chloroperlinae, nymph, dorsal view; 16, Perlodinae, nymph, dorsal view; 17, Isoperlinae, nymph, dorsal view; 18, *Zapada haysi* (Ricker), nymph, head and prothorax; 19, *Utacapnia poda* (Nebeker and Gaufin), leg; 20, *Taenionema pacificum* (Banks), leg; 21, *Hesperoperla pacifica* Banks, nymph, head; 22, *Claassenia sabulosa* (Banks), nymph, head.

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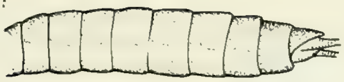

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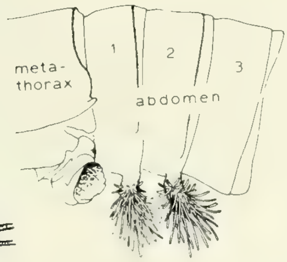

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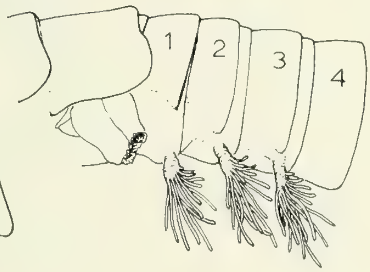

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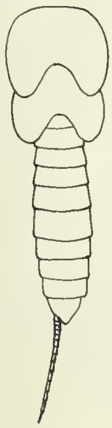

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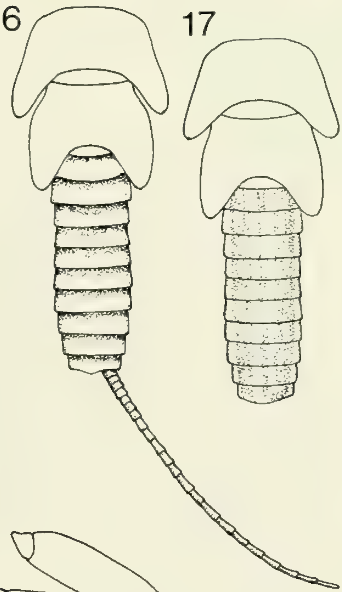

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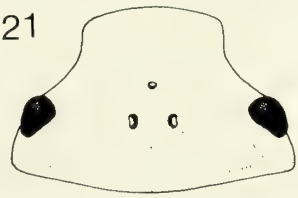

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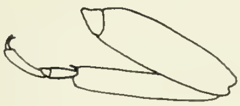

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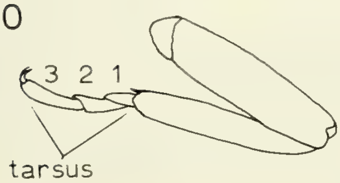

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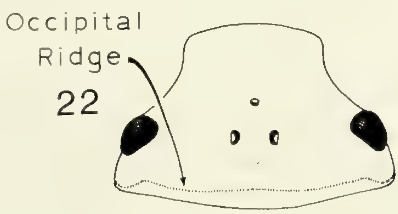


Key to the Subfamilies and Genera of Nemouridae

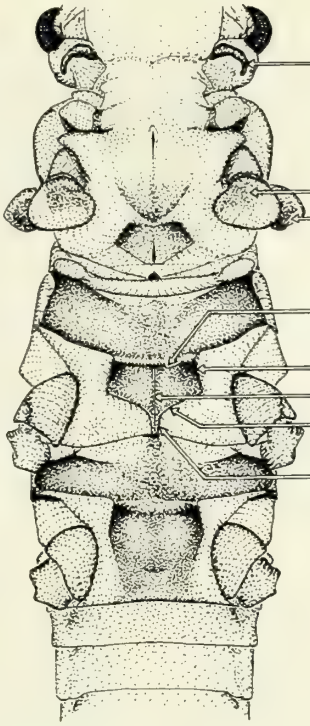
Males

1. Paraprocts divided into three lobes; with spines or prongs on middle or outer lobes (figs. 75, 89) .... AMPHINEMURINAE 2
   Paraprocts single or divided into two lobes; lacking spines on outer lobes (figs. 120, 131) .... NEMOURINAE 3
2. Mesobasal lobe present at base of cerci in dorsal aspect (fig. 89); gill branches not all originating from same point (fig. 137) .... *Malenka*
   Mesobasal lobe absent (fig. 77); gill branches all originating from same point (fig. 136) .... *Amphinemura*
3. Lateral knobs present at basal corners of epiproct; basal cushion present at dorsal base of epiproct (fig. 134) 4
   Lateral knobs absent from basal corners of epiproct; basal cushion absent from dorsal base of epiproct (fig. 86) 6
4. Cervical gills present (fig. 139) .... *Zapada*
   Cervical gills absent 5
5. Paraprocts elongate and greatly enlarged (fig. 120); epiproct bilaterally asymmetrical (fig. 118); cerci small, unsclerotized and unmodified; veins A_1 and A_2 joined near margin of forewings (fig. 143) .... *Soyedina*
   Paraprocts large and rectangular; epiproct bilaterally symmetrical; cerci large, mostly sclerotized, with large hooks near apex (fig. 88); veins A_1 and A_2 not joined .... *Nemoura*
6. Dorsal sclerite of epiproct large and lateral arms well developed (figs. 101, 103) .... *Podmosta*
   Dorsal sclerite of epiproct reduced in size and lateral arms poorly developed (figs. 106, 109) 7
7. Epiproct composed almost completely of ventral sclerite; dorsal sclerite reduced to small projections located at base of epiproct (figs. 105, 106) ...... *Prostoia*
   Epiproct composed of both dorsal and ventral sclerites; dorsal sclerite only slightly reduced in size (figs. 86, 109) 8
8. Submental gills present and highly branched (fig. 138); vesicle present on ninth sternum (fig. 109) .... *Visoka*
   Submental gills absent; vesicle absent from ninth sternum (fig. 86) .... *Lednia*

Females

1. Cervical gills present; submental gills absent (fig. 139) 2
   Cervical gills absent; submental gills sometimes present .... NEMOURINAE (in part) 4

Figures 23-31. — 23, *Isogenoides elongatus* (Hagen), thoracic sterna of adult; 24, *Isoperla fulva* (Claassen), mesosternum, adult; 25, *Isoperla mormona* (Banks), mesosternum, nymph; 26, *Megarcys signata* (Hagen), mesosternum, nymph; 27, *Kogotus modestus* (Banks), mesosternum, adult; 28, *Megarcys signata* (Hagen), mesosternum, adult; 29, *Isogenoides zionensis* (Hanson), mesosternum, nymph; 30, *Diploperla duplicata* (Banks), mesosternum, nymph; 31, *Diploperla duplicata* (Banks), mesosternum, adult.



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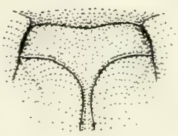
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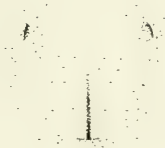
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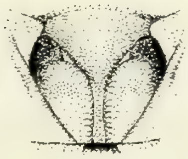
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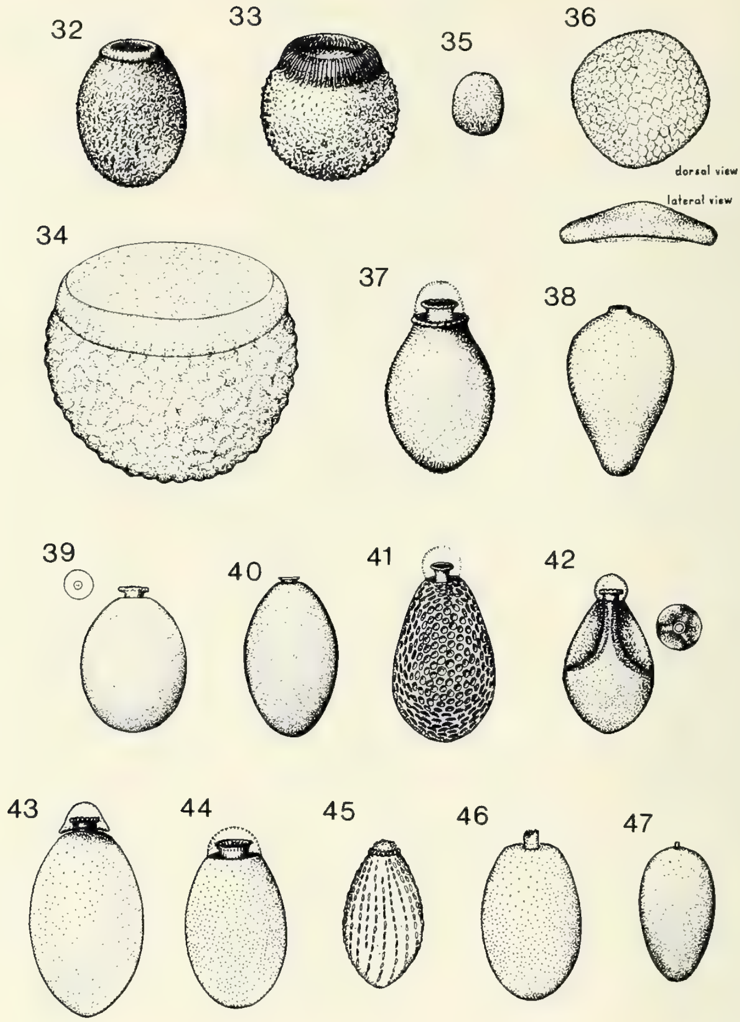


FIGURES 32-47. — Eggs: 32, *Pteronarcella badia* (Hagen); 33, *Pteronarcys californica* Newport; 34, *Pteronarcys princeps* Banks; 35, *Capnia uintahi* Gaufin; 36, *Yoraperla brevis* (Banks); 37, *Hesperoperla pacifica* Banks; 38, *Claassenia sabulosa* (Banks); 39, *Skwala parallela* (Frison); 40, *Diura knowltoni* (Frison); 41, *Isoperla fulva* Claassen; 42, *Isoperla patricia* Frison; 43, *Sweltsa borealis* (Banks); 44, *Triznaka signata* (Banks); 45, *Kathroperla perdita* Banks; 46, *Paraperla frontalis* (Banks); 47, *Utaperla sopladora* Ricker.

2. Cervical gills highly branched (fig. 136) .... AMPHINEMURINAE 3
   Cervical gills simple, with never more than four branches (fig. 139) ....
   .... NEMOURINAE (in part) .... *Zapada*
3. Gill branches not all originating from same point (fig. 137); eighth sternum sclerotized only along median notch (fig. 93) .... *Malenka*
   Gill branches all originating from same point (fig. 136); eighth sternum with sclerotized vaginal lobes (fig. 76) .... *Amphinemura*
4. Submental gills present (fig. 138) .... *Visoka*
   Submental gills absent 5
5. Veins A_1 and A_2 joined near margin of forewings (fig. 143) .... *Soyedina*
   Veins A_1 and A_2 not joined near margin of forewings 6
6. Seventh sternum enlarged into pregenital plate, covering much of sternum eight (fig. 87) .... *Nemoura*
   Seventh sternum not enlarged as pregenital plate 7
7. Eighth sternum with distinct sclerotized pattern 8
   Eighth sternum without distinct sclerotized pattern (fig. 107) .... *Prostoia*
8. Eighth sternum with narrow median sclerotized pattern (fig. 100) .... *Podmosta*
   Eighth sternum with median plate-like patch and lateral sclerotized patches (fig. 83) .... *Lednia*

Nymphs

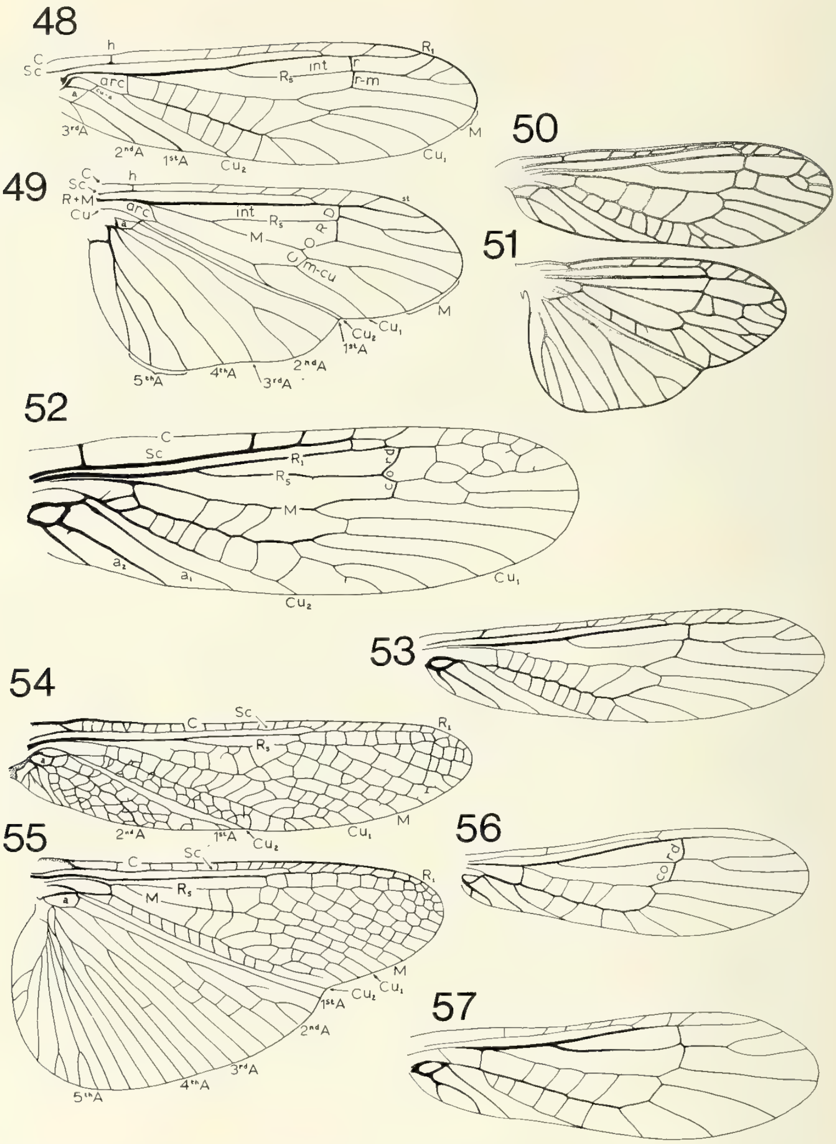
(*Lednia* unknown)

1. Cervical gills present; submental gills absent (fig. 139) 2
   Cervical gills absent; submental gills sometimes present ....
   .... NEMOURINAE (in part) 4
2. Cervical gills branched .... AMPHINEMURINAE (fig. 136) 3
   Cervical gills simple, with never more than four branches (fig. 139) ....
   .... NEMOURINAE (in part) .... *Zapada*
3. Gill branches not all originating from same point (fig. 137) .... *Malenka*
   Gill branches all originating from same point (fig. 136) .... *Amphinemura*
4. Submental gills present (fig. 138) .... *Visoka*
   Submental gills absent 5
5. Pronotum with definite fringe of spines on lateral margins 6
   Pronotum without fringe of spines on lateral margins 7
6. Pronotum rounded at corners, without definite notch on lateral margins ....
   .... *Nemoura*
   Pronotum angular at corners, with definite notch on lateral margins ...... *Soyedina*
7. Foretibiae with fringe of long hairs along outer margin .... *Prostoia*
   Foretibiae without fringe of long hairs along outer margin, but with occasional long hairs .... *Podmosta*

Subfamily Amphinemurinae

Genus AMPHINEMURA Ris 1902

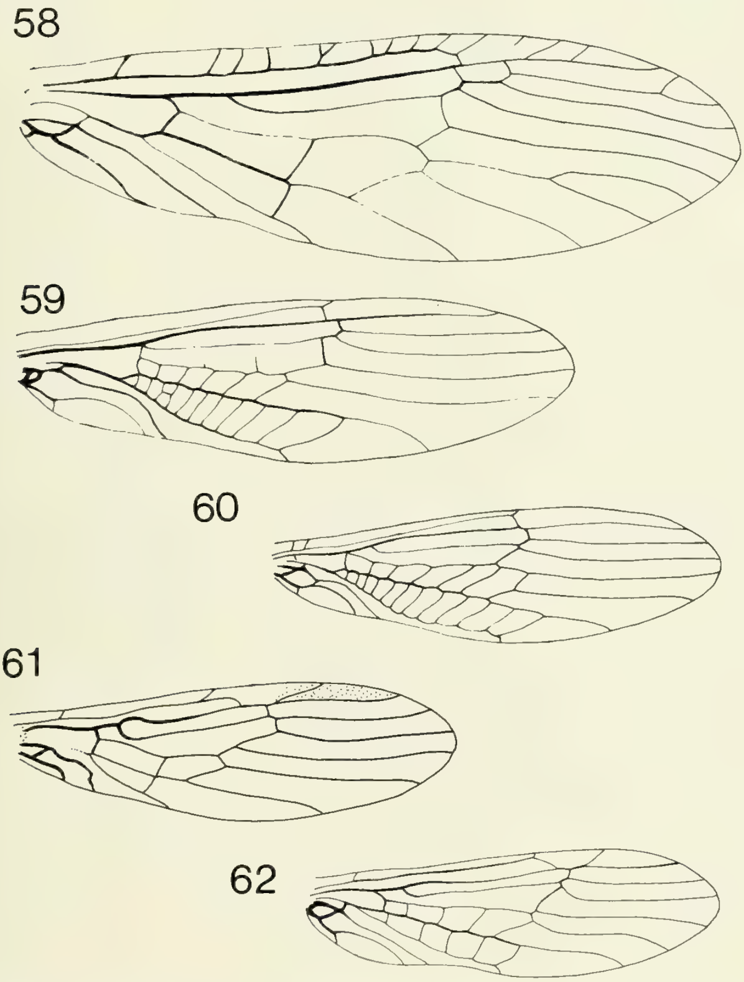
Amphinemura species are not common in the Rocky Mountains except in certain localities in the Central and Southern divisions. Except for *Amphinemura linda* which has Holarctic affinities, all the species be-



FIGURES 48-57. — Wings: *Isoperla fulva* Claassen: 48, right forewing; 49, right hindwing. *Pictetiella expansa* (Banks): 50, right forewing; 51, right hindwing. 52, *Skwala parallela* (Frison), right forewing; 53, *Cultus tostonus* (Ricker), right forewing. *Pteronarcys californica* Newport: 54, right forewing; 55, right hindwing. 56, *Sweltsa fidelis* (Banks), right forewing; 57, *Paraperla frontalis* (Banks), right forewing.

long to the *Amphinemura venusta* complex (Baumann and Gaufin, 1972). This complex is endemic to western North America and is found only in the Rocky Mountains and the Sierra Madre Mountains of Mexico.

The nymphs of *Amphinemura* seem to require clean, cold water that runs throughout the year. To date no collections have been made in intermittent streams that flow only in the winter and early spring as is common for species of Capniidae that exist over the same geographical range.



FIGURES 58-62. — Right forewings: 58, *Isocapnia grandis* (Banks); 59, *Perlomyia utahensis* (Needham and Claassen); 60, *Paraleuctra occidentalis* (Banks); 61, *Mesocapnia* sp.; 62, *Zapada cinctipes* (Banks).

Key to the Species of Amphinemura

Males

1. Epiproct narrowly rounded at apex in both dorsal and lateral aspects (figs. 77, 78) 2
   Epiproct enlarged at apex in both dorsal and lateral aspects (figs. 70, 71) 4
2. Wings uniformly dark throughout; paraprocts short and only slightly recurved dorsally (figs. 77, 78) .... *linda*
   Wings mottled, with light spots in cells on dark background; paraprocts long and recurved dorsally 3
3. Outer lobe of paraprocts short, broad and blunt at tip (fig. 69) .... *banksi*
   Outer lobe of paraprocts long, narrow and pointed at apex (fig. 66) .... *mogollonica*
4. Lateral aspect of epiproct broadly rounded at apex (fig. 70); ventral sclerite with small slightly enlarged carina throughout .... *apache*
   Lateral aspect of epiproct highly angular at apex (fig. 73); ventral sclerite with large ventral directed process at apex .... *venusta*

Females

1. Pregenital plate of seventh sternum completely covering eighth sternum, bluntly forked at apex (fig. 79) .... *apache*
   Pregenital plate of seventh sternum only partially covering eighth sternum, broadly rounded at apex (fig. 76) 2
2. Vaginal lobes well developed and darkly sclerotized; wings mottled 3
   Vaginal lobes poorly developed and with narrow sclerotized apical bands; wings uniformly dark .... *linda*
3. Vaginal lobes with two distinct projections of unequal size .... *venusta*
   Vaginal lobes single or if slightly divided, projections are nearly equal in size .. 4
4. Vaginal lobes broadly rounded at apex .... *banksi*
   Vaginal lobes slightly bifurcate at apex .... *mogollonica*

Amphinemura apache Baumann and Gaufin (figs. 70-72, 79, 142)

Amphinemura apache Baumann and Gaufin 1972, 226: 2, male and female; figs. 2-5, p. 4, male and female genitalia.

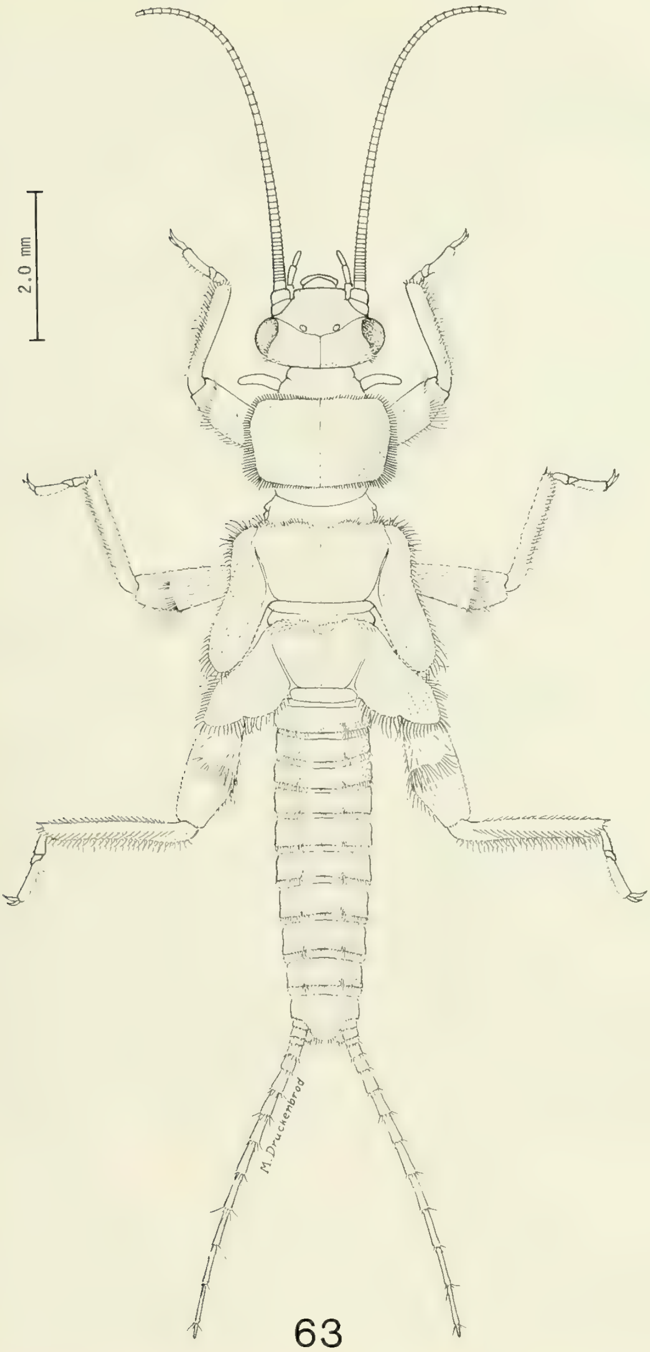
Type locality. — Rucker Creek, Cochise Co., Arizona.

Geographic range. — Southeastern Arizona.

Distribution in Rocky Mts. — (Southern Rockies): ARIZONA: Cochise Co.

Discussion. — This rare species is endemic to the Chiricahua Mts. The adults emerge in July and August.

FIGURE 63. — *Zapada haysi* (Ricker), nymph, habitus.



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Amphinemura banksi Baumann and Gaufin (figs. 67-69, 80)

Nemoura venusta, Needham and Claassen, 1925, 2: 209, male and female; pl. 36, figs. 5-8, p. 363, male and female genitalia.
Nemoura (*Amphinemura*) *venusta,* Ricker, 1952, 18: 27 (in part).
Amphinemura venusta, Illies, 1966, 82: 189-190 (in part).
Nemoura (*Amphinemura*) *venusta,* Gaufin, Nebeker and Sessions, 1966 (in part), figs. 62-63, 72, p. 34-35, 37, male and female genitalia.
Amphinemura banksi Baumann and Gaufin, 1972, 226: 5, male and female; figs. 6-9, p. 4, male and female genitalia; fig. 23, p. 11, female internal genitalia.

Type locality. — Hidden Valley Creek, Rocky Mountain N. P., Colorado.

Geographic range. — Rocky Mts.

Distribution in Rocky Mts. — (Northern, Central and Southern Rockies): ARIZONA: Apache Co. COLORADO: Boulder Co.; Chaffee Co.; El Paso Co.; Gilpin Co.; Grand Co.; Gunnison Co.; Jackson Co.; Larimer Co.; Las Animas Co.; Mineral Co.; Rio Blanco Co.; Routt Co.; Summit Co.; Teller Co. IDAHO: Clark Co. MONTANA: Gallatin Co.; Glacier Co.; Judith Basin Co.; Lewis and Clark Co. SOUTH DAKOTA: Lawrence Co. UTAH: Cache Co.; Daggett Co.; Duchesne Co.; San Juan Co.; Summit Co.; Uintah Co.; Utah Co.; Wasatch Co. WYOMING: Albany Co.; Fremont Co.; Johnson Co.; Lincoln Co.; Park Co.; Platte Co.; Sublette Co.; Teton Co.; Uinta Co.

Discussion. — This species occurs commonly in creeks and rivers. The adults emerge in July and August.

Amphinemura linda (Ricker) (figs. 76-78)

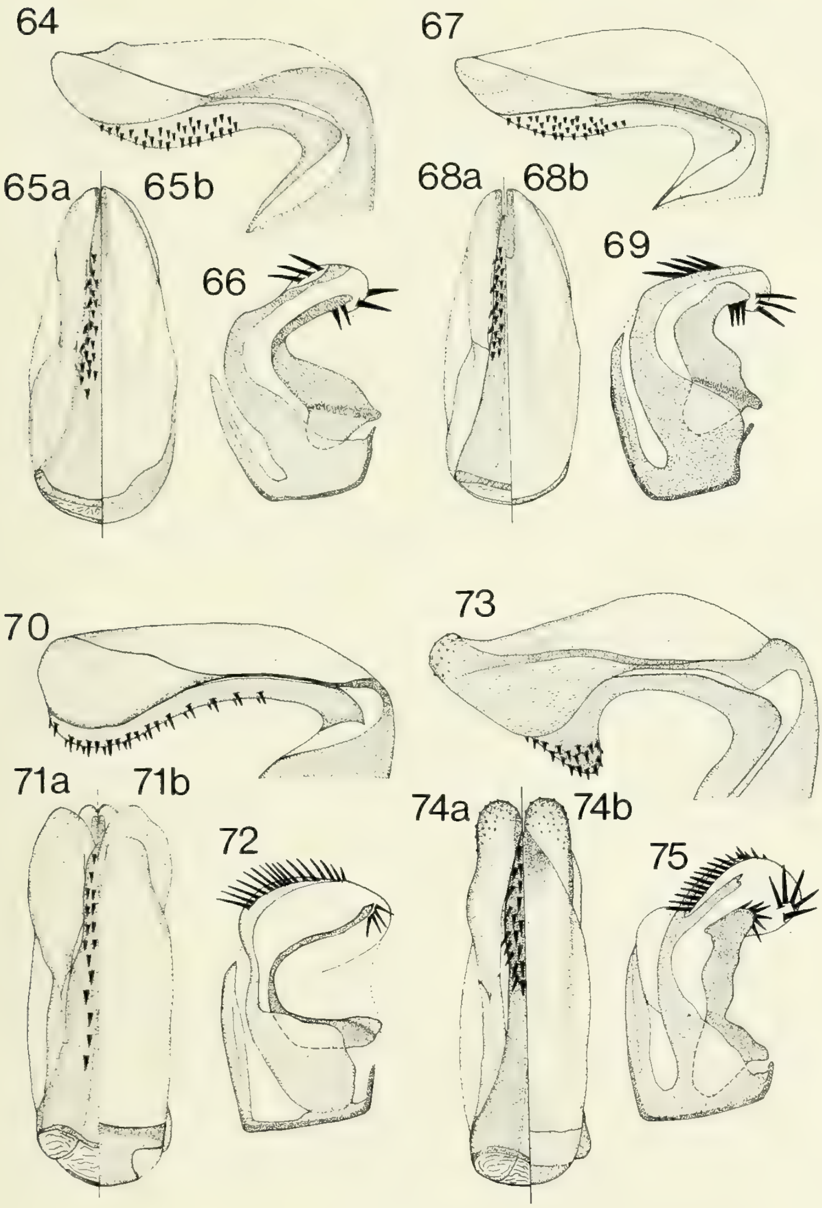
Nemoura (*Amphinemura*) *linda* Ricker, 1952, 18:22, male and female; figs. 8, 11-12, p. 23, male and female genitalia.
Amphinemura linda, Illies, 1966, p. 181.

Type locality. — Hunt Creek, Montmorency Co., Michigan.

Geographic range. — Northern North America.

Distribution in Rocky Mts. — (Canadian and Central Rockies): ALBERTA: Banff N. P. BRITISH COLUMBIA: Alcan Hwy. mile 496, Liard River; Bowron Lake P. P.; Quesnel. COLORADO: Grand Co., Grand Lake.

FIGURES 64-75. — *Amphinemura mogollonica* Baumann and Gaufin: 64, epiproct, lateral view; 65a, epiproct, ventral view; 65b, epiproct, dorsal view; 66, paraproct, ventral-lateral view. *Amphinemura banksi* Baumann and Gaufin; 67, epiproct, lateral view; 68a, epiproct, ventral view; 68b, epiproct, dorsal view; 69, paraproct, ventral-lateral view. *Amphinemura apache* Baumann and Gaufin: 70, epiproct, lat-



eral view; 71a, epiproct, ventral view; 71b, epiproct, dorsal view; 72, paraproct, ventral-lateral view. *Amphinemura venusta* (Banks): 73, epiproct, lateral view; 74a, epiproct, ventral view; 74b, epiproct, dorsal view; 75, paraproct, ventral-lateral view.

Discussion. — This species, although widespread in Alaska, Canada and the north central United States, seems to be uncommon in the Rocky Mts. The adults emerge from June to August.

Amphinemura mogollonica Baumann and Gaufin (figs. 64-66, 81)

Nemoura venusta, Ricker, 1952, 18: 27 (in part).
Nemoura venusta, Gaufin, Nebeker and Sessions, 1966, 14: 35 (in part).
Amphinemura venusta, Illies, 1966, 82: 189-190 (in part).
Amphinemura mogollonica Baumann and Gaufin, 1972, 226: 9, male and female; figs. 14-17, 24, p. 11, male and female genitalia; fig. 24, female internal genitalia.

Type locality. — Christopher Creek, Gila Co., Arizona.

Geographic range. — Arizona, New Mexico, Utah.

Distribution in Rocky Mts. — (Southern Rockies): ARIZONA: Apache Co.; Cochise Co.; Gila Co.; Graham Co. NEW MEXICO: Grant Co.; Sandoval Co. UTAH: Beaver Co.; Emery Co.; Sanpete Co.; Sevier Co.; Washington Co.

Discussion. — This species is common in the Southern Rocky Mts., usually occurring in creeks and rivers. The adults emerge from July to September.

Amphinemura venusta (Banks) (figs. 73-75, 82)

Nemoura venusta Banks, 1911, 37: 337.
Nemoura venusta, Needham and Claassen, 1925, 2: 209 (holotype only).
Nemoura (Amphinemura) venusta, Ricker, 1952, 18: 27 (in part).
Amphinemura venusta, Illies, 1966, 82: 189-190 (in part).
Amphinemura venusta, Baumann and Gaufin, 1972, 226: 13, male and female; figs. 18-21, p. 11, male and female genitalia.

Type locality. — Huachuca Mts., Arizona.

Geographic range. — Southern Arizona to Mexico, D. F.

Distribution in Rocky Mts. — (Southern Rockies): ARIZONA: Cochise or Santa Cruz Co., Huachuca Mts.

Discussion. — This rare species has been collected from only one locality in the United States. The adults were collected in July.

Genus MALENKA Ricker 1952

Malenka is the sister genus of *Amphinemura* and is endemic to Western North America. This genus has radiated extensively throughout the Pacific Northwest and is found on island mountain ranges in the American Southwest almost to the Mexican border.

The nymphs are similar to those of *Amphinemura* but can be distinguished by the details of the cervical gills (fig. 137). Adult specimens are small, brown and somewhat frail for Nemouridae. They are most

easily collected by beating streamside vegetation. The males have distinctive mesobasal lobes on the cerci (figs. 91, 92); and the females exhibit a small nipple-like structure on the seventh sternum when viewed laterally.

Most *Malenka* species emerge in the late summer or early fall. Species that live in spring habitats have an extended emergence pattern. In fact, *Malenka* is the most common nemourid genus in both large and small springs throughout its range.

Key to the Species of Malenka

Males

1. Mesobasal lobes of cerci sclerotized and pointed (fig. 89) .... *californica*
   Mesobasal lobes of cerci membranous and rounded 2
2. Apex of subanal lobes deeply bifurcate (figs. 97, 98) .... *tina*
   Apex of subanal lobes not deeply divided 3
3. Apex of subanal lobes slender and conspicuously twisted (figs. 94, 95) .. *flexura*
   Apex of subanal lobes blunt, with posterior median carina and short lateral prongs (figs. 91, 92) .... *coloradensis*

Females

1. Median notch completely bisecting eighth sternum (fig. 96) 2
   Median notch not completely bisecting eighth sternum (fig. 93) 3
2. Notch of eighth sternum narrow in anterior third, with series of transverse folds laterally; knob on posterior margin of seventh sternum pointed (fig. 96) .... *flexura*
   Notch of eighth sternum wide in anterior third, without transverse folds; knob on posterior margin of seventh sternum rounded (fig. 99) .... *tina*
3. Notch of eighth sternum cut about halfway through the segment, margins not sclerotized (fig. 90) .... *californica*
   Notch of eighth sternum cut almost to anterior margin of segment, margins lightly sclerotized (fig. 93) .... *coloradensis*

Malenka californica (Claassen) (figs. 89, 90)

Nemoura californica Claassen, 1923, 55: 284, male; fig. 7, p. 283, male genitalia (female misidentified).

Nemoura californica, Needham and Claassen, 1925, 2: 207; figs. 16-18, p. 361, male and female genitalia.

Nemoura californica, Neave, 1929, 4: 162, female; fig. 8, female genitalia.

Nemoura lobata Frison, 1936, 29: 260.

Nemoura (*Malenka*) *californica,* Ricker, 1952, 18: 33.

Malenka californica, Illies, 1966, 82: 191.

Type locality. — Oakland Hills, Alameda Co., California.

Geographic range. — Coast, Cascade, Rocky and Sierra Nevada Mts.

Distribution in Rocky Mts. — (Canadian, North and Central Rock-

ies): ALBERTA: Banff N. P.; Waterton Lakes N. P. BRITISH COLUMBIA: Bear Lake; Douglas Lake; Prince George; Summerland; Vernon. COLORADO: Grand Co.; Larimer Co.; Routt Co. IDAHO: Bannock Co.; Bonner Co.; Bonneville Co.; Custer Co.; Franklin Co.; Fremont Co.; Goodling Co.; Idaho Co.; Latah Co.; Lemhi Co.; Shoshone Co.; Teton Co. MONTANA: Broadwater Co.; Flathead Co.; Gallatin Co.; Glacier Co.; Jefferson Co.; Lake Co.; Lewis and Clark Co.; Missoula Co.; Park Co. NEVADA: Lander Co.; White Pine Co. UTAH: Box Elder Co.; Cache Co.; Duchesne Co.; Juab Co.; Salt Lake Co.; Summit Co.; Utah Co.; Wasatch Co.; Weber Co. WYOMING: Albany Co.; Park Co.; Teton Co.

Discussion. — The nymphs are common in small creeks in the fall but rare in the spring. Emergence usually occurs in the fall but spring-dwelling populations begin emerging in March and continue until December.

Malenka coloradensis (Banks) (figs. 91-93)

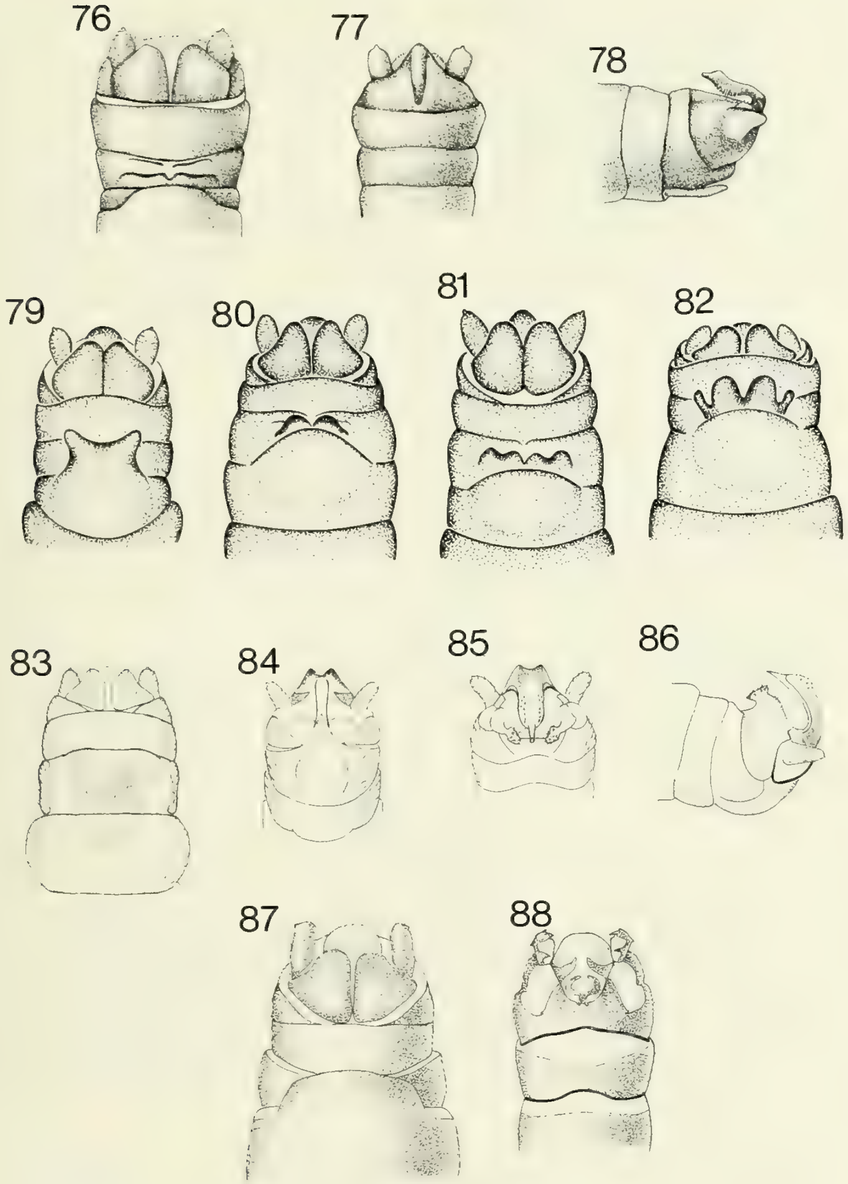
Nemoura coloradensis Banks, 1897, 24: 21.
Nemoura coloradensis, Needham and Claassen, 1925, 2: 210, male and female; figs. 13-16, p. 363, male and female genitalia.
Nemoura coloradensis, Claassen, 1931, 3: 96, nymph.
Nemoura (Malenka) coloradensis, Ricker, 1952, 18: 33.
Malenka coloradensis, Illies, 1966, 82: 192.

Type locality. — Fort Collins, Colorado.

Geographic range. — Rocky Mts.

Distribution in Rocky Mts. — (Central and Southern Rockies): ARIZONA: Apache Co.; Cochise Co.; Graham Co.; Pima Co. COLORADO: Boulder Co.; Chaffee Co.; Clear Creek Co.; Conejos Co.; Custer Co.; Delta Co.; El Paso Co.; Gilpin Co.; Gunnison Co.; Hinsdale Co.; Jefferson Co.; La Plata Co.; Larimer Co.; Park Co.; Routt Co.; Teller Co. NEW MEXICO: Catron Co.; Lincoln Co.; San Miguel Co.; Santa Fe Co.; Taos Co.; Torrance Co. SOUTH DAKOTA: Custer Co.; Lawrence Co. UTAH: Beaver Co.; Duchesne Co.; Grande Co.; Iron Co.; San Juan Co.; Sevier Co.; Washington Co. WYOMING: Albany Co.; Fremont Co.

FIGURES 76-88. — *Amphinemura linda* (Ricker): 76, female terminalia, ventral view; 77, male terminalia, dorsal view; 78, male terminalia, lateral view. 79, *Amphinemura apache* Baumann and Gaufin, female terminalia, ventral view. 80, *Amphinemura banksi* Baumann and Gaufin, female terminalia, ventral view; 81, *Amphinemura mogollonica* Baumann and Gaufin, female terminalia, ventral view; 82,



Amphinemura venusta (Banks), female terminalia, ventral view. *Lednia tumana* (Ricker): 83, female terminalia, ventral view; 84, male terminalia, ventral view; 85, male terminalia, dorsal view; 86, male terminalia, lateral view. *Nemoura arctica* Esben-Petersen: 87, female terminalia, ventral view; 88, male terminalia, dorsal view.

Discussion. — This species is widely distributed in the Southern Rocky Mts. The adults emerge from June to November.

Malenka flexura (Claassen) (figs. 94-96)

Nemoura flexura Claassen, 1923, 55: 284, male and female; figs. 9-10, p. 283, male and female genitalia.
Nemoura (*Malenka*) *flexura*, Ricker, 1952, 18: 34.
Malenka flexura, Illies, 1966, 82: 192.

Type locality. — Boulder, Colorado.

Geographic range — Coast, Cascade and Rocky Mts.

Distribution in Rocky Mts. — (Canadian, Northern, Central and Southern Rockies): ALBERTA: Banff N. P.; Waterton Lakes N. P. COLORADO: Boulder Co.; Conejos Co.; Eagle Co.; Garfield Co.; Gilpin Co.; Grand Co.; Larimer Co.; Routt Co. IDAHO: Adams Co.; Blaine Co.; Bonner Co.; Custer Co.; Fremont Co.; Idaho Co.; Latah Co.; Lemhi Co.; Kootenai Co.; Nez Perce Co.; Shoshone Co. MONTANA: Cascade Co.; Flathead Co.; Gallatin Co.; Glacier Co.; Granite Co.; Lake Co.; Lewis and Clarke Co.; Missoula Co.; Powell Co.; Ravalli Co.; Sweet Grass Co. NEW MEXICO: Taos Co. WYOMING: Big Horn Co.; Carbon Co.; Park Co.

Discussion. — This species occurs commonly in springs, creeks and small rivers. The adults emerge from March to December.

Malenka tina (Ricker) (figs. 97-99)

Nemoura (*Malenka*) *tina* Ricker, 1952, 18: 34, male; figs. 16-18, p. 34, male genitalia.
Nemoura (*Malenka*) *tina*, Jewett, 1954, 11: 543, female; fig. 1, female genitalia.
Malenka tina, Illies, 1966, 82: 193.

Type locality. — Iron Creek, Lewis Co., Washington.

Geographic range. — Coast, Cascade and Rocky Mts.

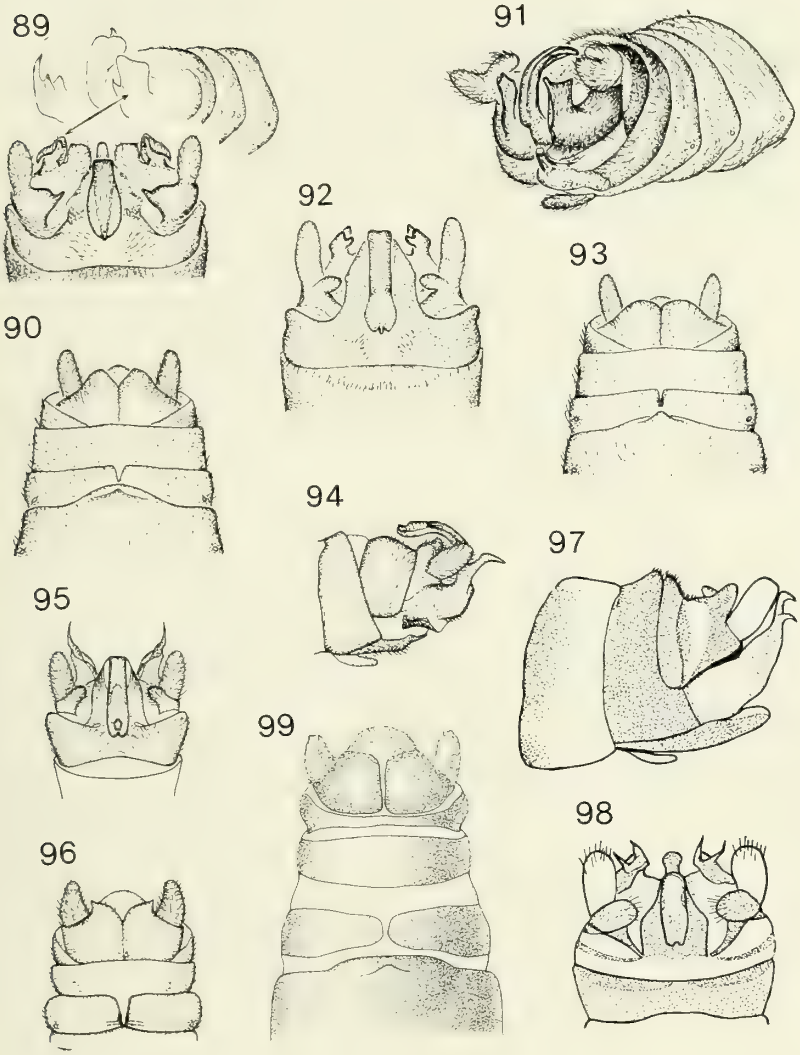
Distribution in Rocky Mts. — (Northern and Central Rockies): IDAHO: Blaine Co.; Butte Co.; Idaho Co.; Lemhi Co.; Minidoka Co.; Twin Falls Co. MONTANA: Missoula Co. NEVADA: Elko Co.

Discussion. — This species is rather restricted in its distribution. The adults emerge in June and July.

Subfamily Nemourinae

Genus LEDNIA Ricker 1952

This species has only been collected at two localities in Glacier National Park. Both collections are from relatively high elevations in the middle of the summer season.



FIGURES 89-99. — *Malenka californica* (Claassen): 89, male terminalia, dorsal and posterior views; 90, female terminalia, ventral view. *Malenka coloradensis* (Banks): 91, male terminalia; 92, male terminalia, dorsal view; 93, female terminalia, ventral view. *Malenka flexura* (Claassen): 94, male terminalia, lateral view; 95, male terminalia, dorsal view; 96, female terminalia, ventral view. *Malenka tina* (Ricker): 97, male terminalia, lateral view; 98, male terminalia, dorsal view; 99, female terminalia, ventral view.

The males are the only nemourids in western North America that do not have a lobe on sternum nine (fig. 84). The females have a distinctly sclerotized triangular pattern on the subgenital plate (fig. 83). The nymphs are presently unknown.

Lednia tumana (Ricker) (figs. 83-86)

Nemoura (Lednia) tumana Ricker, 1952, 18: 27, male and female; figs. 13-15, p. 28, male and female genitalia.
Lednia tumana, Illies, 1966, 82: 190.
Nemoura (Lednia) tumana, Gaufin et al., 1972, 98: 31.

Type locality. — Many Glacier, Glacier N. P., Montana.

Geographic range. — This species is known only from Glacier N. P.

Distribution in Rocky Mts. — (Northern Rockies): MONTANA: Flathead Co.; Glacier Co.

Discussion. — Emerging adults of this rare species have been collected in July and August.

Genus NEMOURA Latreille 1796

This is the type-genus of the family Nemouridae. It is extremely common in most of Europe and Asia but is limited to mostly northern localities in North America.

The males have distinctive sclerotized hooks on the tips of their cerci (fig. 88); and the females have a combination of lightly sclerotized, angular cerci and a well developed pregenital plate on sternum seven (fig. 87). Females are very difficult to identify at the species level but some success has been realized by clearing and staining the sclerotizations of the vagina.

Nemoura arctica Esben-Petersen (figs. 87, 88)

Nemoura arctica Esben-Petersen, 1910, 31/32: 85.
Nemoura (Nemoura) arctica, Ricker, 1952, 18: 36.
Nemoura arctica, Ricker, 1964, 34/35: 62, distribution map.

Type locality. — Norway.

Geographic range. — Arctic or far northern areas of Europe, Asia and North America.

Distribution in Rocky Mts. — (Canadian and Central Rockies): BRITISH COLUMBIA: Summit Lake, Alaska Hwy., mile 392. SOUTH DAKOTA: Spearfish Creek, Lawrence Co.

Discussion. — This species has a circumpolar distribution. It has only been collected from two localities in the Rocky Mountains. The record from northern British Columbia is the real *N. arctica.* The record from

South Dakota could be a relict population of *N. arctica* or possibly an undescribed species but an exact identification cannot be made until males are collected in South Dakota. The adults emerge from June to August.

Genus PODMOSTA Ricker 1952

This genus represents a group of small stoneflies that are seldom encountered by the average collector. They are usually found in small creeks at high elevations.

The males have very intricate epiproctal structures which have been poorly studied because of their very small size (figs. 101, 102). Females are characterized by distinctive sclerotized areas along the median portion of sternum eight (fig. 100).

Adults are usually collected by sweeping with a heavy net in willows, sedges or tall grass.

Key to the Species of Podmosta

Males

1. Epiproct short and broad, with pair of sharp hook-like processes near apex (fig. 103) .... *decepta*
   Epiproct with broad base and somewhat narrower apex, dorsal portion with pair of blunt fork-like processes near apex (figs. 101, 102) .... *delicatula*

Females

1. Median sclerotized band on sternum eight long and narrow (fig. 100) .. *delicatula*
   Median sclerotized band short, broad and rounded at base (fig. 104) .... *decepta*

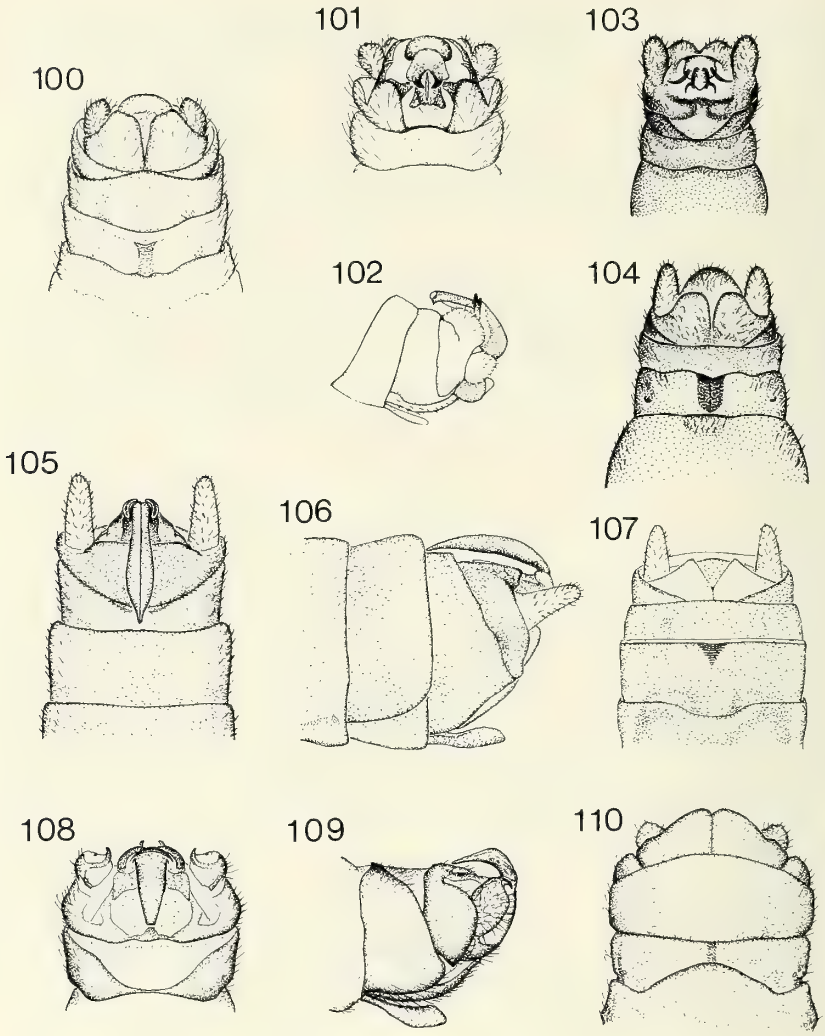
Podmosta decepta (Frison) (figs. 103, 104)

Nemoura decepta Frison, 1942a, 18: 13, male; fig. 2, male genitalia.
Nemoura decepta, Ricker, 1943, 12: 67, female and nymph; figs. 33-37, male and female genitalia and outline of nymph.
Nemoura (*Podmosta*) *decepta,* Ricker, 1952, 18: 43.
Nemoura (*Podmosta*) *rossi* Ricker, 1952, 18: 44.
Podmosta decepta, Illies, 1966, 82: 219.

Type locality. — Estes Park, Colorado.

Geographic range. — Coast, Cascade and Rocky Mts.

Distribution in Rocky Mts. — (Canadian, Northern and Central Rockies): ALBERTA: Waterton Lakes N. P. BRITISH COLUMBIA: Red Bug Slough, Upper Peace River Dist. COLORADO: Grand Co.; Jackson Co.; Larimer Co.; Routt Co. IDAHO: Benewah Co.; Blaine Co.; Bonner Co.; Bonneville Co.; Idaho Co.; Latah Co.; Minidoka Co.; Shoshone Co. MONTANA: Cascade Co.; Flathead Co.; Gallatin Co.; Gla-



FIGURES 100-110. — *Podmosta delicatula* (Claassen): 100, female terminalia, ventral view; 101, male terminalia, dorsal view; 102, male terminalia, lateral view. *Podmosta decepta* (Frison): 103, male terminalia, dorsal view; 104, female terminalia, ventral view. *Prostoia besametsa* (Ricker): 105, male terminalia, dorsal view; 106, male terminalia, lateral view; 107, female terminalia, ventral view. *Visoka cataractae* (Neave): 108, male terminalia, dorsal view; 109, male terminalia, lateral view; 110, female terminalia, ventral view.

cier Co.; Granite Co.; Lake Co.; Lewis and Clark Co.; Meagher Co.; Mineral Co.; Missoula Co.; Ravalli Co. UTAH: Summit Co. WYOMING: Albany Co.; Park Co.; Teton Co.

Discussion. — This species is found in small to medium sized creeks and sometimes in cold mountain lakes. The adults emerge from April to August.

Podmosta delicatula (Claassen) (figs. 100-102)

Nemoura delicatula Claassen, 1923, 55: 283, male and female; figs. 13-14, male and female genitalia.
Nemoura (Podmosta) delicatula, Ricker, 1952, 18: 43.
Podmosta delicatula, Illies, 1966, 82: 219.

Type locality. — Boulder, Colorado.

Geographic range. — Coast, Cascade and Rocky Mts.

Distribution in Rocky Mts. — (Canadian, Northern, Central and Southern Rockies): ALBERTA: Banff N. P. SASKATCHEWAN: Bear Creek, Cypress Hills. COLORADO: Boulder Co.; Clear Creek Co.; Eagle Co.; Grand Co.; Hinsdale Co.; Jackson Co.; Lake Co.; Larimer Co.; Routt Co.; Summit Co. IDAHO: Adams Co.; Bannock Co.; Blaine Co.; Bonner Co.; Bonneville Co.; Caribou Co.; Custer Co.; Idaho Co.; Latah Co.; Lemhi Co.; Valley Co. MONTANA: Flathead Co.; Gallatin Co.; Glacier Co.; Granite Co.; Lake Co.; Lewis and Clark Co.; Lincoln Co.; Meagher Co.; Mineral Co.; Missoula Co.; Park Co.; Powell Co.; Ravalli Co. NEVADA: Elko Co. NEW MEXICO: Rio Arriba Co.; Taos Co. UTAH: Davis Co.; Duchesne Co.; Emery Co.; Rich Co.; Salt Lake Co.; Summit Co.; Wasatch Co. WYOMING: Albany Co.; Carbon Co.; Fremont Co.; Johnson Co.; Park Co.; Sublette Co.; Teton Co.

Discussion. — The nymphs are common in creeks and rivers throughout their range. The adults emerge from April to August.

Genus PROSTOIA Ricker 1952

This genus contains three known species all limited to North America. The male epiproct is highly reduced in size and complexity, with the dorsal sclerites represented by very small curved processes at the base of the epiproct (figs. 105-106). The female terminalia are very simple with only a small lightly sclerotized area on the posterior portion of sternum eight (fig. 107).

Prostoia can be very abundant in some lowland creeks and rivers and often emerges in great numbers in the early spring. The adults are small and move very quickly on warm days.

Prostoia besametsa (Ricker) (figs. 105-107, 140)

Nemoura glabra Claassen, 1923, 55: 281 (in part).
Nemoura completa, Ricker, 1943, 12: 68, nymph; fig. 32, p. 67, outline of nymph.
Nemoura (*Prostoia*) *besametsa* Ricker, 1952, 18: 48, male and female; fig. 20, p. 44, male genitalia.
Prostoia besametsa, Illies, 1966, 82: 220.

Type locality. — Vedder Crossing, British Columbia.

Geographic range. — Coast, Cascade, Rocky and Sierra Nevada Mts.

Distribution in Rocky Mts. — (Canadian, Northern, Central and Southern Rockies): ALBERTA: Banff N. P. BRITISH COLUMBIA: Penticton; Summit Lake; Toad Road Lodge. COLORADO: Archuleta Co.; Boulder Co.; Chaffee Co.; Clear Creek Co.; Eagle Co.; Garfield Co.; Gilpin Co.; Grand Co.; Gunnison Co.; Hinsdale Co.; Jefferson Co.; Larimer Co.; Routt Co.; Summit Co. IDAHO: Adams Co.; Bannock Co.; Blaine Co.; Bonneville Co.; Boundary Co.; Custer Co.; Franklin Co.; Fremont Co.; Idaho Co.; Latah Co.; Lemhi Co.; Shoshone Co. MONTANA: Broadwater Co.; Cascade Co.; Flathead Co.; Gallatin Co.; Glacier Co.; Jefferson Co.; Lake Co.; Lewis and Clark Co.; Lincoln Co.; Mineral Co.; Missoula Co.; Park Co.; Ravalli Co.; Sweet Grass Co. NEVADA: No locality. NEW MEXICO: Rio Arriba Co.; Santa Fe Co.; Taos Co. UTAH: Box Elder Co.; Cache Co.; Daggett Co.; Davis Co.; Emery Co.; Millard Co.; Morgan Co.; Piute Co.; Salt Lake Co.; Sevier Co.; Tooele Co.; Utah Co.; Wasatch Co.; Washington Co.; Weber Co. WYOMING: Albany Co.; Platte Co.

Discussion. — This species is common in creeks and small rivers throughout its range. The adults emerge from March to August.

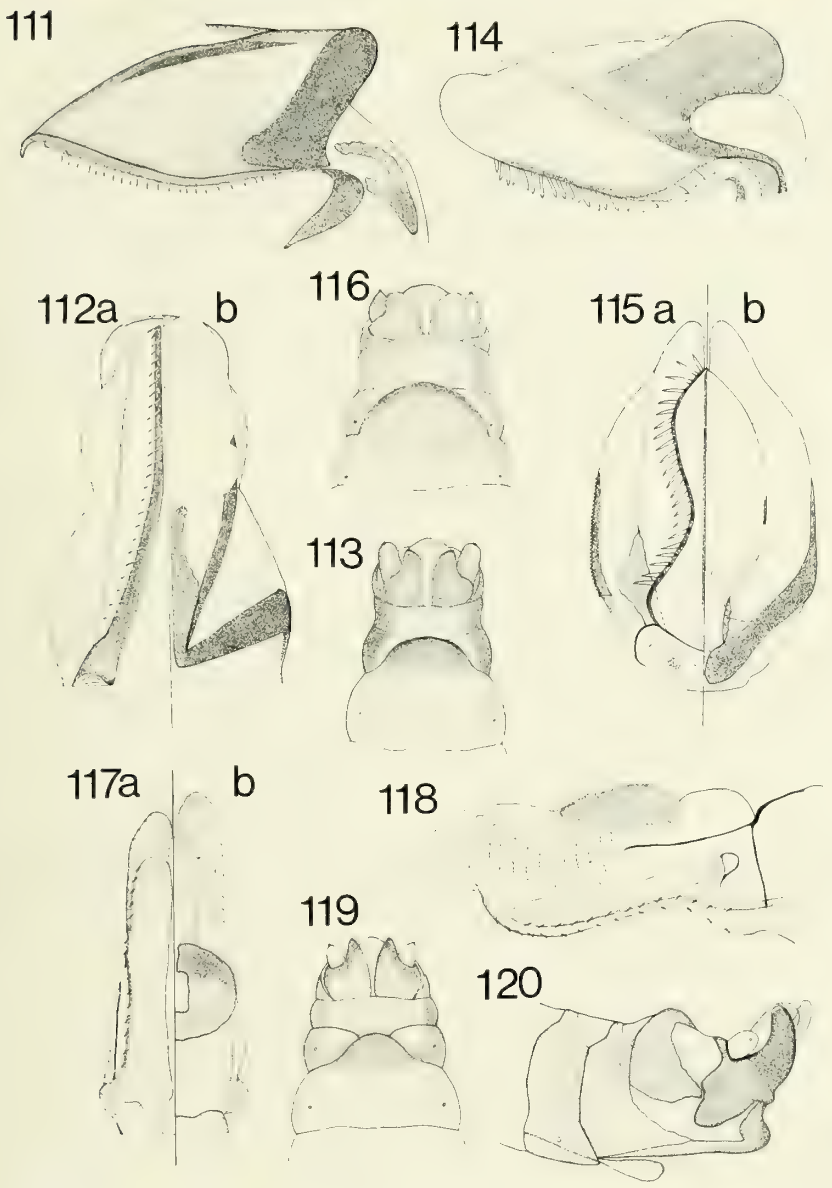
Genus SOYEDINA Ricker 1952

Soyedina is endemic to North America. Only one species, *S. potteri,* has been collected to date in the Rocky Mountains.

Adults are distinguished by the fusion of veins A_1 and A_2 in the forewings near the wing margin (fig. 143). The males have greatly enlarged paraprocts and exhibit a bilateral asymmetry in the epiproct (figs. 117, 118). Females are very similar to *Nemoura* females but *Soyedina* females have completely membranous cerci and fused anal veins (fig. 119).

Nymphs are found in small creeks and seeps. Sometimes the habitat is only outwardly damp with no sign of running water.

FIGURES 111-120. — *Zapada glacier* (Baumann and Gaufin): 111, epiproct, lateral view; 112a, epiproct, ventral view; 112b, epiproct dorsal view; 113, female termin-



alia, ventral view. *Zapada cordillera* (Baumann and Gaufin): 114, epiproct, lateral view; 115a, epiproct, ventral view; 115b, epiproct, dorsal view; 116, female terminalia, ventral view. *Soyedina potteri* (Baumann and Gaufin): 117a, epiproct, ventral view; 117b, epiproct, dorsal view; 118, epiproct, lateral view; 119, female terminalia, ventral view; 120, male terminalia, lateral view.

Soyedina potteri (Baumann and Gaufin) (figs. 117-120)

Nemoura (Soyedina) nevadensis interrupta, Logan and Smith, 1966, 9: 1.
Nemoura (Soyedina) potteri Baumann and Gaufin, 1971b, 47: 271, male and female; figs. 1-7, p. 272, male and female genitalia.
Soyedina potteri, Zwick, 1973, 94: 357.

Type locality. — Butler Creek, Missoula Co., Montana.

Geographic range. — This species has only been recorded from Idaho and Montana.

Distribution in Rocky Mts. — (Northern Rockies): IDAHO: Clearwater Co.; Idaho Co. MONTANA: Flathead Co.; Glacier Co.; Missoula Co.

Discussion. — This species occurs in creeks and small springs. The adults emerge from April to July.

Genus VISOKA Ricker 1952

Visoka is the only genus in Nemouridae where the nymphs have gills attached to the lateral margins of the submentum (fig. 138). These gills serve much the same function as cervical gills and are often mistaken for such.

The males have delicate hooks on the apex of the cerci and the epiproct is reduced in size and complexity (figs. 108-109). Females look much like *Nemoura* females but can be separated by the presence of submental gills.

Visoka cataractae (Neave) (figs. 108-110, 138)

Nemoura cataractae Neave, 1933, 65: 236, male; figs. 3-4, male genitalia.
Nemoura cataractae, Ricker, 1943, female and nymph; figs. 20-22, female genitalia and outline of nymph.
Nemoura (Visoka) cataractae, Ricker, 1952, 18: 54.
Visoka cataractae, Illies, 1966, 82: 249.

Type locality. — Cataract Brook, Lake O'Hara, British Columbia.

Geographic range. — Coast, Cascade and Rocky Mts.

Distribution in Rocky Mts. — (Canadian and Northern Rockies): ALBERTA: Banff N. P.; Waterton Lakes N.P. BRITISH COLUMBIA: Glacier N. P. IDAHO: Blaine Co.; Boise Co.; Bonner Co.; Bonneville Co.; Idaho Co.; Lemhi Co. MONTANA: Flathead Co.; Gallatin Co.; Glacier Co.; Lake Co.; Missoula Co.; Ravalli Co.

Discussion. — This species occurs primarily in creeks. It is found in torrential habitats. The adults emerge from March to July.

Genus ZAPADA Ricker 1952

This is the most common genus of the family *Nemouridae* in the Rocky Mountains. *Zapada* species are found in almost every flowing water habitat in the northern Rocky Mountains and *Z. cinctipes* is the most vagile species in the whole group, Euholognatha.

The genus is distinguished by the presence of two pairs of cervical gills, one on the inside and one on the outside of the lateral cervical sclerites (fig. 139).

Zapada species are abundant in accumulations of leaf material and probably act as shredders of allochthonous material in heterotrophic lotic ecosystems.

Key to the Species of Zapada

Males

1. Wings uniformly brown; cervical gills 12-15 times as long as wide .... *frigida*
   Wings mottled, with dark bands (fig. 62); cervical gills less than ten times as long as wide 2
2. Gills with 3-4 branches .... *cinctipes*
   Gills simple and unbranched 3
3. Gills constricted at base and one or more times beyond .... *columbiana*
   Gills constricted at base only, if at all 4
4. Wings slightly brachypterous, crossveins in intercubital and median areas aberrant (fig. 141) .... *cordillera*
   Wings macropterous, crossveins normal 5
5. Epiproct with two sclerotized dorsal hooks (figs. 133, 134) .... *oregonensis*
   Epiproct entirely membranous dorsally 6
6. Dorsal aspect of epiproct with large membranous area near apex (fig. 112); epiproct triangular in lateral aspect (fig. 111) .... *glacier*
   Dorsal aspect of epiproct with small membranous area near apex (fig. 133); epiproct ovoid in lateral aspect (fig. 131) .... *haysi*

Females

1. Wings uniformly brown; cervical gills 12-15 times as long as wide .... *frigida*
   Wings mottled, with dark bands (fig. 62); cervical gills less than ten times as long as wide 2
2. Gills with 3-4 branches; subgenital plate with posterior margin truncate (fig. 123) .... *cinctipes*
   Gills simple and unbranched (fig. 139); subgenital plate with posterior margin rounded 3
3. Gills constricted at base and one or more times beyond .... *columbiana*
   Gills constricted at base only, if at all 4
4. Wings slightly brachypterous, crossveins in intercubital and median areas aberrant (fig. 141) .... *cordillera*
   Wings macropterous, crossveins normal 5

5. Subgenital plate greatly produced; narrowly rounded at apex (fig. 135) .... *oregonensis*
   Subgenital plate moderately produced; broadly rounded or nearly truncate at apex 6
6. Subgenital plate nearly truncate or bluntly rounded at apex (fig. 132) .... *haysi*
   Subgenital plate broadly rounded at apex (fig. 113) .... *glacier*

Nymphs

1. Cervical gills 12-15 times as long as wide .... *frigida*
   Cervical gills less than ten times as long as wide 2
2. Gills with 3-4 branches .... *cinctipes*
   Gills simple and unbranched (fig. 139) 3
3. Gills constricted at base and one or more times beyond .... *columbiana*
   Gills constricted at base only, if at all .... *oregonensis* group

Zapada cinctipes (Banks) (figs. 62, 121-123)

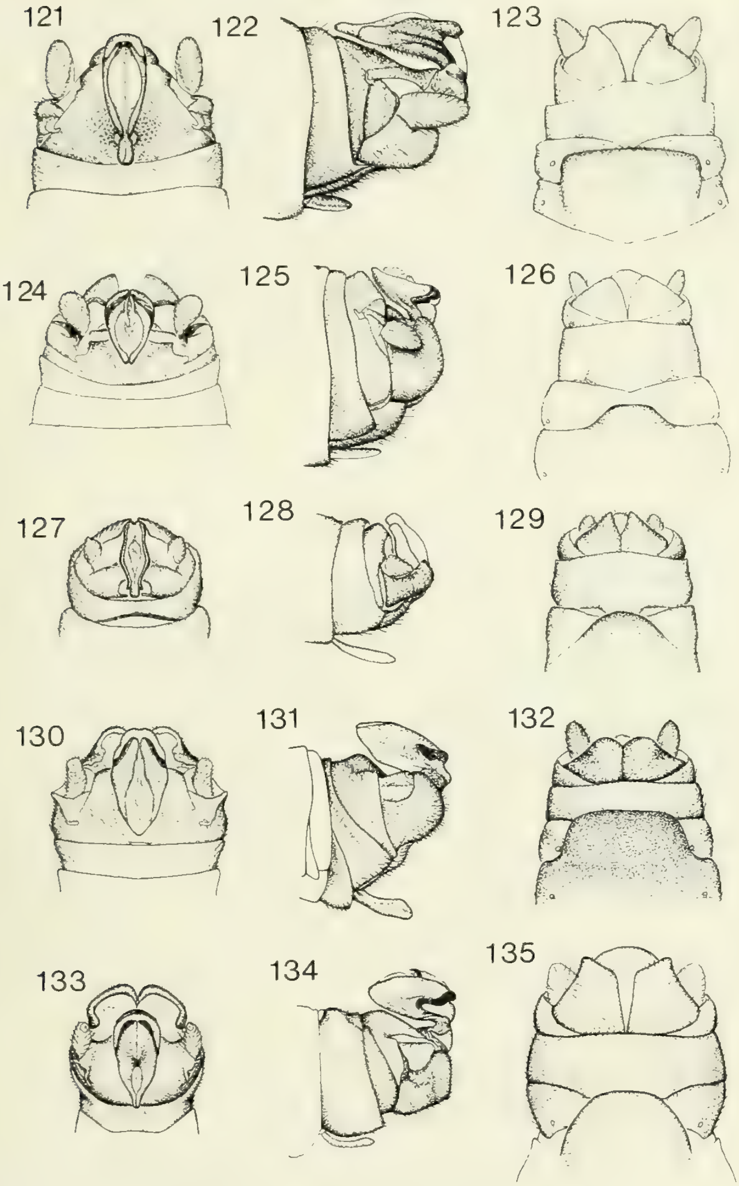
Nemoura cinctipes Banks, 1897, 24: 21.
Nemoura cinctipes, Needham and Claassen, 1925, 2: 212, male and female; fig. 2, p. 225, wings; figs. 5-8, p. 365, male and female genitalia.
Nemoura cinctipes, Castle, 1939, 71: 208, nymph; fig. 1, nymphal gills.
Nemoura (Zapada) cinctipes, Ricker, 1952, 18: 57.
Zapada cinctipes, Illies, 1966, 82: 250.

Type locality. — Olympia, Washington.

Geographic range. — Coast, Cascade, Rocky and Sierra Nevada Mts.

Distribution in Rocky Mts. — (Canadian, Northern, Central and Southern Rockies): ALBERTA: Banff N. P.; Waterton Lakes N. P. BRITISH COLUMBIA: Purcell Range; Selkirk Mts.; Summit Lake. SASKATCHEWAN: Cypress Lake, Cypress Hills. COLORADO: Boulder Co.; Chaffee Co.; Eagle Co.; Delta Co.; Grand Co.; Gunnison Co.; Jackson Co.; La Plata Co.; Larimer Co.; Montrose Co.; Routt Co.; Saguache Co.; Summit Co. IDAHO: Adams Co.; Bannock Co.; Bear Lake Co.; Benewah Co.; Blaine Co.; Bonner Co.; Bonneville Co.; Boundary Co.; Caribou Co.; Cassia Co.; Clearwater Co.; Custer Co.; Franklin Co.; Fremont Co.; Goodling Co.; Idaho Co.; Kootenai Co.; Lake Co.; Latah Co.; Lemhi Co.; Lewis Co.; Nez Perce Co.; Oneida Co.; Shoshone Co.; Teton Co.; Valley Co. MONTANA: Broadwater Co.; Carbon Co.; Cascade Co.; Flathead Co.; Gallatin Co.; Glacier Co.; Granite Co.; Jefferson Co.; Lake Co.; Lewis and Clark Co.; Lincoln Co.; Mineral Co.; Missoula Co.; Park Co.; Powell Co.; Ravalli Co.; Sanders Co. NEVADA: White

FIGURES 121-135. — *Zapada cinctipes* (Banks): 121, male terminalia, dorsal view; 122, male terminalia, lateral view; 123, female terminalia, ventral view. *Zapada columbiana* (Claassen): 124, male terminalia, dorsal view; 125, male terminalia, lateral view; 126, female terminalia, ventral view. *Zapada frigida* (Claassen): 127,



male terminalia, dorsal view; 128, male terminalia, lateral view; 129, female terminalia, ventral view. *Zapada haysi* (Ricker): 130, male terminalia, dorsal view; 131, male terminalia, lateral view; 132, female terminalia, ventral view. *Zapada oregonensis* (Claassen): 133, male terminalia, dorsal view; 134, male terminalia, lateral view; 135, female terminalia, ventral view.

Pine Co. NEW MEXICO: Sandoval Co.; Santa Fe Co.; Taos Co. SOUTH DAKOTA: Lawrence Co. UTAH: Box Elder Co.; Cache Co.; Davis Co.; Duchesne Co.; Iron Co.; Kane Co.; Morgan Co.; Salt Lake Co.; Sanpete Co.; Sevier Co.; Summit Co.; Tooele Co.; Uintah Co.; Utah Co.; Wasatch Co.; Washington Co.; Weber Co. WYOMING: Albany Co.; Carbon Co.; Fremont Co.; Lincoln Co.; Park Co.; Platte Co.; Sublette Co.

Discussion. — This species is common throughout western North America. It has been collected in all of the Rocky Mountain states except Arizona. This species usually emerges from February to August, but has been collected in all months of the year in some localities.

Zapada columbiana (Claassen) (figs. 124-126)

Nemoura columbiana Claassen, 1923, 55: 285, male; fig. 15, p. 283, male genitalia.
Nemoura columbiana, Neave, 1933, 65: 238, female; fig. 5, p. 236, female genitalia.
Nemoura columbiana, Ricker, 1943, 12: 61, nymph; fig. 24, p. 60, gill of nymph.
Nemoura (Zapada) columbiana, Ricker, 1952, 18: 57.
Zapada columbiana, Illies, 1966, 82: 250.

Type locality. — Laggan (Lake Louise), Alberta.

Geographic range. — Coast, Cascade, Rocky and Sierra Nevada Mts.

Distribution in Rocky Mts. — (Canadian, Northern, and Central Rockies): ALBERTA: Banff N. P.; Waterton Lakes N. P. BRITISH COLUMBIA: Kaslo; Mt. Revelstoke; Purcell Range; Selkirk Mts. IDAHO: Bear Lake Co.; Blaine Co.; Boise Co.; Bonner Co.; Bonneville Co.; Boundary Co.; Idaho Co.; Lemhi Co.; Valley Co. MONTANA: Cascade Co.; Flathead Co.; Gallatin Co.; Glacier Co.; Granite Co.; Lake Co.; Missoula Co.; Powell Co.; Ravalli Co. UTAH: Cache Co.; Davis Co.; Salt Lake Co.; Summit Co.; Utah Co. WYOMING: Lincoln Co.; Park Co.; Sublette Co.; Teton Co.

Discussion. — This species is most common in the Pacific Northwest occurring in creeks and small rivers. The adults emerge from February through July.

Zapada cordillera (Baumann and Gaufin) (figs. 114-116, 141)

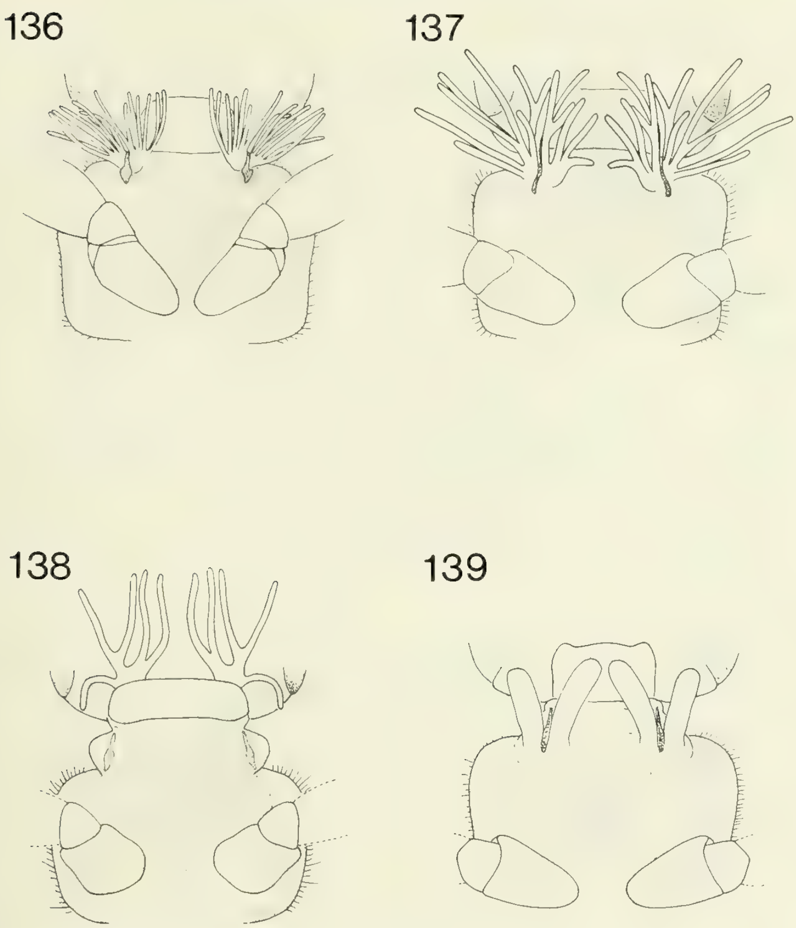
Nemoura (Zapada) cordillera Baumann and Gaufin 1971b, 47: 273, male and female; figs. 8-14, p. 274, male and female genitalia.

Type locality. — Butler Creek, Missoula Co., Montana.

Geographic range. — Montana, Idaho, Oregon and Washington.

Distribution in Rocky Mts. — (Northern Rockies): IDAHO: Idaho Co.; MONTANA: Flathead Co.; Missoula Co.; Lake Co.

Discussion. — This rare species occurs in creeks and rivers. The adults emerge from March to May.



FIGURES 136-139. — Cervical area of nymphs: 136, *Amphinemura* sp.; 137, *Malenka* sp.; 138, *Visoka* sp.; 139, *Zapada* sp.

Zapada frigida (Claassen) (figs. 127-129)

Nemoura frigida Claassen, 1923, 55: 283, male; fig. 12, p. 283, male genitalia.
Nemoura frigida, Ricker, 1943, 12: 59, female and nymph; figs. 23, 25, p. 60, female genitalia and outline of nymph.
Nemoura (Zapada) frigida, Ricker, 1952, 18: 57.
Zapada frigida, Illies, 1966, 82: 251.

Type locality. — Sitka, Alaska.

Geographic range. — Coast, Cascade, Rocky and Sierra Nevada Mts.

Distribution in Rocky Mts. — (Canadian, Northern, Central and Southern Rockies): ALBERTA: Banff N. P.; Waterton Lakes N. P.

BRITISH COLUMBIA: Kootenay N. P.; Purcell Range. COLORADO: Boulder Co.; Chaffee Co.; Hinsdale Co.; Mineral Co.; Summit Co. IDAHO: Bonner Co.; Bonneville Co.; Custer Co.; Idaho Co.; Lemhi Co.; Lewis Co. MONTANA: Flathead Co.; Gallatin Co.; Glacier Co.; Golden Valley Co.; Granite Co.; Lake Co.; Lewis and Clark Co.; Mineral Co.; Missoula Co.; Ravalli Co. NEW MEXICO: Lincoln Co.; San Miguel Co.; Santa Fe Co.; Taos Co. UTAH: San Juan Co.

Discussion. — The nymphs are usually found in small headwater streams and spring-fed creeks. This species is found primarily in the northwest but is never common. The adults emerge from March to August.

Zapada glacier (Baumann and Gaufin) (figs. 111-113)

Nemoura (*Zapada*) *glacier* Baumann and Gaufin, 1971b, 47: 275, male and female; figs. 15-19, p. 276, male and female genitalia.

Type locality. — Cataract Creek, Glacier N. P., Montana.

Geographic range. — Glacier N. P., Montana.

Distribution in Rocky Mts. — (Northern Rockies): MONTANA: Glacier Co.

Discussion. — The nymphs have been collected only in precipitous, glacier-fed streams in a small area of Glacier N. P. The adults have been collected in July.

Zapada haysi (Ricker) (figs. 18, 63, 130-132)

Nemoura (*Zapada*) *haysi* Ricker, 1952, 18: 58, male and female; figs. 32-35, p. 58, male and female genitalia.
Zapada haysi, Illies, 1966, 182: 251.

Type locality. — Upper Gallatin River, Yellowstone N. P., Wyoming.

Geographic range. — Coast, Cascade, Rocky and Sierra Nevada Mts.

Distribution in Rocky Mts. — (Canadian, Northern, Central and Southern Rockies): ALBERTA: Banff N. P. BRITISH COLUMBIA: Valhalla Mts.; Summit Lake; Toad River. COLORADO: Clear Creek Co.; Garfield Co.; Grand Co.; Hinsdale Co.; Jackson Co.; Lake Co.; Larimer Co.; Pitkin Co.; Routt Co.; Summit Co. IDAHO: Bear Lake Co.; Blaine Co.; Bonner Co.; Bonneville Co.; Franklin Co.; Lemhi Co. MONTANA: Cascade Co.; Flathead Co.; Gallatin Co.; Glacier Co.; Lake Co.; Lewis and Clark Co.; Meagher Co.; Missoula Co.; Stillwater Co. NEVADA: White Pine Co. NEW MEXICO: Lincoln Co.; Santa Fe Co.; Taos Co. UTAH: Cache Co; Rich Co.; Salt Lake Co.; Sevier Co.; Summit Co.; Tooele Co.; Utah Co.; Sanpete Co. WYOMING: Albany Co.; Park Co.; Sublette Co.; Teton Co.

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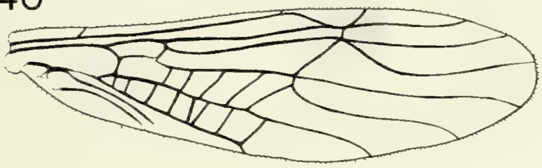

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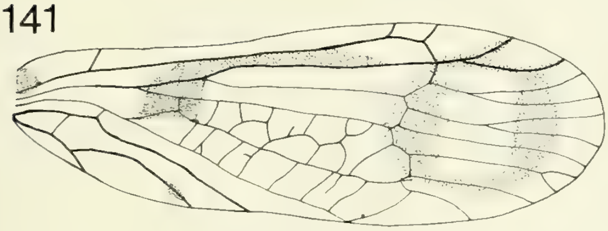

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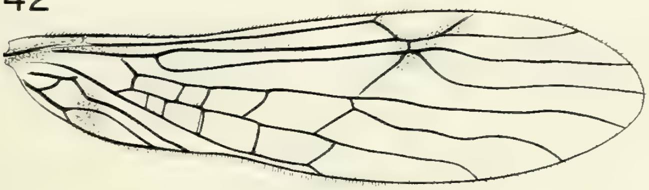

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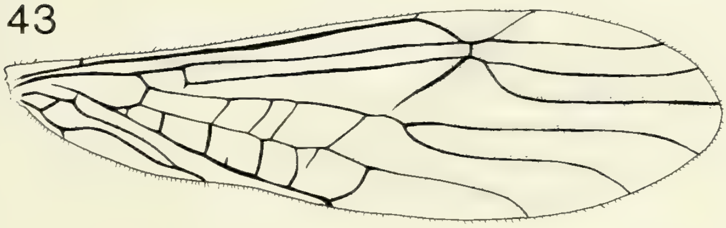

FIGURES 140-143. — Right forewings: 140, *Prostoia besametsa* (Ricker); 141, *Zapada cordillera* (Baumann and Gaufin); 142, *Amphinemura apache* Baumann and Gaufin; 143, *Soyedina producta* (Claassen).

Discussion. — This species is widely distributed but is not usually common. The nymphs are found in both creeks and small rivers. The adults emerge from April to July.

Zapada oregonensis (Claassen) (figs. 133-135)

Nemoura oregonensis Claassen, 1923, 55: 288, male; fig. 24, p. 283, male genitalia.
Nemoura oregonensis, Frison, 1937, 21: 83, female; fig. 70, p. 84, female genitalia.
Nemoura oregonensis, Ricker (in part), 1943, 12: 61, nymph.
Nemoura (Zapada) oregonensis, Ricker, 1952, 18: 60.
Zapada oregonensis, Illies, 1966, 82: 251.

Type locality. — Harney Co., Oregon.

Geographic range. — Coast, Cascade, Rocky and Sierra Nevada Mts.

Distribution in Rocky Mts. — (Canadian, Northern, Central and Southern Rockies): ALBERTA: Banff N. P. BRITISH COLUMBIA: Kamloops; Kaslo; Selkirk Mts.; Summerland. COLORADO: Boulder Co.; Clear Creek Co.; Custer Co.; Eagle Co.; Grand Co.; Gunnison Co.; Hinsdale Co.; Larimer Co.; Routt Co.; San Juan Co. IDAHO: Blaine Co.; Boise Co.; Bonner Co.; Bonneville Co.; Butte Co.; Franklin Co.; Fremont Co.; Idaho Co.; Lemhi Co.; Shoshone Co. MONTANA: Beaverhead Co.; Carbon Co.; Flathead Co.; Gallatin Co.; Glacier Co.; Lake Co.; Lewis and Clark Co.; Missoula Co.; Ravalli Co.; Sweet Grass Co. WYOMING: Albany Co.; Park Co.; Teton Co.

Discussion. — This species is common in creeks and small rivers in the Northern Rocky Mountains. The adults emerge from March through August. This species has been recorded from Utah previously, but all specimens seen proved to be *Zapada haysi* (Ricker).

Family **Taeniopterygidae**

This family is very similar to the family Nemouridae. The adult males have the cerci reduced to single segments in all genera except *Taeniopteryx.* The nymphs are quite stout and the wing pads are divergent from the body axis. The adults are usually brown or black and they fly after emergence to adjacent vegetation. In fact an excellent collecting method is to beat or shake bushes or limbs and then pick up the specimens that are dislodged. Adults emerge in the spring except at high altitudes where cooler temperatures delay emergence to the summer months.

The only sure method of separating the nymphs from those of the family Nemouridae is by the size ratio of the tarsal segments. In Nemouridae the second tarsal segment is much shorter than the first while in Taeniopterygidae the second tarsal segment is at least as long or longer than the

first (figs. 19, 20). One characteristic that is usually helpful in general sorting, however, is that nymphs of the family Taeniopterygidae usually curl up when preserved in alcohol.

Key to the Subfamilies and Genera of Taeniopterygidae

Males

1. Cerci composed of a single segment (fig. 153) .... TAENIOPTERYGINAE .... *Taeniopteryx*
   Cerci with three or more segments .... BRACHYPTERINAE 2
2. Epiproct with two prongs (figs. 156, 157); no costal crossveins .... *Oemopteryx*
   Epiproct with single prong; with 1-5 costal crossveins 3
3. Basal plate of epiproct fully sclerotized and bearing two erect lobes; prong of epiproct slightly asymmetrical (figs. 159, 160) .... *Doddsia*
   Basal plate of epiproct lacking lobes, and with large membranous spaces; prong of epiproct symmetrical (figs. 144, 145) .... *Taenionema*

Females

1. Ninth sternum not extending to base of subanal lobes (fig. 155) .... TAENIOPTERYGINAE .... *Taeniopteryx*
   Ninth sternum extending well beyond base of subanal lobes (fig. 158) .... BRACHYPTERINAE 2
2. Forewing without costal crossveins .... *Oemopteryx*
   Forewing with 1-5 costal crossveins 3
3. Vein R_s with three branches and vein Cu_1 with four or five branches .... *Doddsia*
   Vein R_s with two branches and vein Cu_1 with two or three branches .... *Taenionema*

Nymphs

1. Coxal gills present .... TAENIOPTERYGINAE .... *Taeniopteryx*
   Coxal gills absent .... BRACHYPTERINAE 2
2. Cerci with a dense fringe of long setae .... *Doddsia*
   Cerci without a dense fringe of long setae 3
3. Basal segments of cerci with single long setae .... *Oemopteryx*
   Cercal segments without long setae .... *Taenionema*

Subfamily Brachypterinae

Genus DODDSIA Needham and Claassen 1925

Doddsia is a monotypic genus that is endemic to western North America. It is found at high elevations in creeks and small rivers. The adults have only two ocelli and the wings are mottled much like in the nemourid genus *Zapada*.

The males have large, paired posterior projections on the tenth tergum (fig. 159). These projections are narrow and parallel-sided but with enlarged, sharply angled, truncate tips. The subgenital plate of the female is rounded with a pointed apex (fig. 161).

Doddsia occidentalis (Banks) (figs. 159-161)

Taeniopteryx occidentalis Banks, 1900a, 26: 244.
Taeniopteryx (*Doddsia*) *occidentalis,* Needham and Claassen, 1925, 2: 250, male and female; figs. 1-2, p. 381, male genitalia; fig. 1, p. 383, female genitalia.
Brachyptera (*Doddsia*) *occidentalis,* Jewett 1959, 3: 54.
Doddsia occidentalis, Illies, 1966, 82: 61.

Type locality. — Mt. Rainer, Washington.

Geographic range. — Western North America.

Distribution in Rocky Mts. — (Canadian, Northern, Central and Southern Rockies): BRITISH COLUMBIA: Purcell Range; Dawson Creek; Kaslo; Summit Lake; Vavenby. COLORADO: Boulder Co.; Chaffee Co.; Hinsdale Co.; Saguache Co.; Gunnison Co. IDAHO: Bonneville Co. MONTANA: Flathead Co.; Gallatin Co.; Glacier Co.; Granite Co.; Lake Co.; Lincoln Co.; Missoula Co. NEVADA: White Pine Co. UTAH: Cache Co.; Salt Lake Co.; Utah Co. WYOMING: Albany Co.

Discussion. — Nymphs are found in small rivers or streams at fairly high elevations. The adults emerge from February to May.

Genus OEMOPTERYX Klapalek 1902

This genus has a Holarctic distribution pattern and is found exclusively in large relatively unpolluted but silty rivers. Most collecting localities in Europe no longer contain this genus because of the activities of man.

The males have short, thin forewings which are bent abruptly upward at a ninety degree angle near the apex. Males are flightless and are only collected near the edge of the water.

In the Rocky Mountains this genus is limited to large rivers in the Missouri, Colorado and Saskatchewan River drainages.

Oemopteryx fosketti (Ricker) (figs. 156-158)

Brachyptera glacialis, Frison, 1942b, 22: 251 (Utah record).
Brachyptera fosketti Ricker, 1965, 22: 475.
Brachyptera zelona Ricker, 1965, 22: 477.
Oemopteryx fosketti, Zwick, 1973, 94: 303.

Type locality. — South Saskatchewan River, Clarksboro, Saskatchewan.

FIGURES 144-152. — *Taenionema pacificum* (Banks): 144, male terminalia, dorsal view; 145, male terminalia, lateral view; 146, female terminalia, ventral view. *Taenionema pallidum* Banks: 147, male terminalia, dorsal view; 148, male terminalia,

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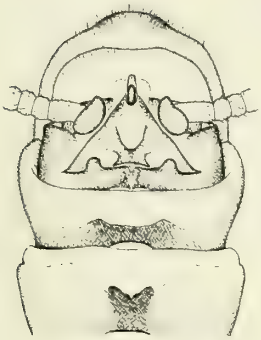

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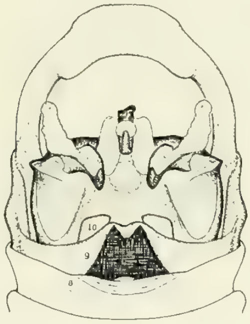

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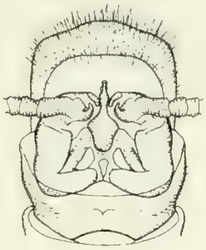

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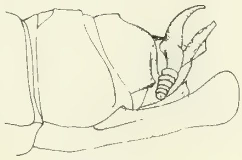

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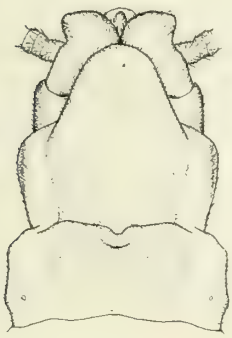

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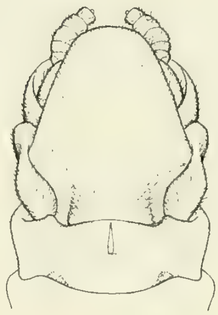

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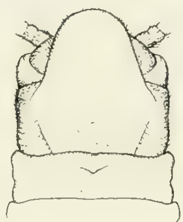


lateral view; 149, female terminalia, ventral view. *Taenionema nigripenne* (Banks): 150, male terminalia, dorsal view; 151, male terminalia, lateral view; 152, female terminalia, ventral view.

Geographic range. — Western North America.

Distribution in Rocky Mts. — (Canadian, Central and Southern Rockies): ALBERTA: South Saskatchewan River, Medicine Hat. SASKATCHEWAN: South Saskatchewan River, Clarksboro and Saskatoon. COLORADO: Mesa Co.; Moffat Co. MONTANA: Dawson Co.; Treasure Co. UTAH: Duchesne Co.; Uintah Co.

Discussion. — Male adults possess very short, narrow wings which bend abruptly upward apically. This species is restricted to large rivers in the plains area of western North America. The adults emerge from January to March.

Genus TAENIONEMA Banks 1905

This genus has an amphinearctic distribution pattern with one species in eastern North America and seven species in western North America. Three species are found in the Rocky Mountains.

The adults can be very abundant when emerging and one species was implicated by Newcomer (1918) as damaging fruit blossoms. This is a rare example of economic damage caused by Plecoptera. *Taenionema* adults are easily collected by sweeping vegetation or by shaking trees or bushes.

Taenionema was treated as being of the feminine gender but Steyskal in Baumann (1976) showed that it is neuter. This necessitated a change in the ending of the specific names in the genus.

Key to the Species of Taenionema

Males

1. Tenth tergum bearing paired sclerotized processes 2
   Tenth tergum without sclerotized processes (figs. 150, 151) .... *nigripenne*
2. Processes on tenth tergum small and rounded (figs. 144, 145) .... *pacificum*
   Processes on tenth tergum large and truncate (figs. 147, 148) .... *pallidum*

Taenionema nigripenne (Banks) (figs. 150-152)

Taeniopteryx nigripennis Banks, 1918, 62: 8.
Taeniopteryx nigripennis, Needham and Claassen, 1925, 2: 245, male and female; figs. 7-8, p. 281, male genitalia; fig. 4, p. 383, female genitalia.
Taeniopteryx (Taenionema) nigripennis, Ricker, 1943, 12: 53, nymph; fig. 17, p. 54, nymph.
Brachyptera (Taenionema) nigripennis, Jewett, 1959, 3: 54, fig. 17, p. 54, nymph.
Taenionema nigripennis, Illies, 1966, 82: 69.
Taenionema nigripenne, Ricker and Ross, 1975, 53: 144.

Type locality. — Wenatchee, Washington.

Geographic range. — Western United States and Canada.

Distribution in Rocky Mts. — (Canadian, Northern, Central and Southern Rockies): ALBERTA: Ft. McMurray. BRITISH COLUMBIA: Purcell Range; Kaslo; Kidd Creek, near Yahk; Mt. Revelstoke; Summit Lake. ARIZONA: No locality. COLORADO: Boulder Co.; Clear Creek Co.; Delta Co.; Eagle Co.; Grand Co.; Larimer Co.; Routt Co.; Summit Co.; Gunnison Co. IDAHO: Bonneville Co.; Franklin Co. MONTANA: Carbon Co.; Cascade Co.; Flathead Co.; Gallatin Co.; Glacier Co.; Granite Co.; Lake Co.; Missoula Co.; Park Co.; Ravalli Co.; Sweetgrass Co. NEVADA: White Pine Co. NEW MEXICO: Santa Fe Co.; Sandoval Co. OREGON: Baker Co.; Union Co. UTAH: Beaver Co.; Box Elder Co.; Cache Co.; Davis Co.; Juab Co.; Salt Lake Co.; Uintah Co.; Utah Co.; Wasatch Co.; Weber Co. WYOMING: Albany Co.

Discussion. — This is a very common species in creeks in the Rocky Mountains. Adults exhibit both light and dark color phases. Emergence occurs from March to August.

Taenionema pacificum (Banks) (figs. 20, 144-146)

Taeniopteryx pacifica Banks, 1900a, 26: 244.
Taenionema analis Banks, 1905, 12: 57.
Taeniopteryx pacifica, Needham and Claassen, 1925, 2: 246, male and female; figs. 11-12, p. 381, male genitalia; fig. 3, p. 383, female genitalia.
Brachyptera (*Taenionema*) *pacifica,* Jewett, 1959, 3: 54.
Taenionema pacifica, Illies, 1966, 82: 69.
Taenionema pacificum, Ricker and Ross, 1975, 53: 144.

Type locality. — Pullman, Washington.

Geographic range. — Western United States and Canada.

Distribution in Rocky Mts. — (Canadian, Northern, Central and Southern Rockies): ALBERTA: Banff N. P. BRITISH COLUMBIA: Campbell Creek, Purcell Range; Kaslo. ARIZONA: Coconino Co. COLORADO: Boulder Co.; Gunnison Co.; Hinsdale Co.; LaPlata Co.; Larimer Co.; Moffat Co.; Montrose Co.; Routt Co. IDAHO: Idaho Co.; Kootenai Co.; Lewis Co. MONTANA: Broadwater Co.; Gallatin Co.; Glacier Co.; Lake Co.; Lincoln Co.; Missoula Co.; Ravalli Co. OREGON: Baker Co.; Umatilla Co. UTAH: Cache Co.; Daggett Co.; Duchesne Co.; Grand Co.; Kane Co.; Salt Lake Co.; Summit Co.; Utah Co.; Wasatch Co.; Washington Co.; Weber Co. WASHINGTON: Whitman Co. WYOMING: Platte Co.

Discussion. — This species is found primarily in rivers in the north but also occurs in streams in the southern part of its range. The adults emerge from March to July.

Taenionema pallidum (Banks) (figs. 147-149)

Nemoura pallida Banks, 1902, 34: 125.
Taeniopteryx pallida Banks, 1918, 62: 9.
Taeniopteryx pallida, Needham and Claassen, 1925, 2: 250, female; fig. 11, p. 383, female genitalia.
Taeniopteryx kincaidi Hoppe, 1938, 4: 164.
Taeniopteryx (*Taenionema*) *kincaidi,* Ricker, 1943, 12: 51, male and nymph; fig. 15, p. 54, male genitalia, fig. 16, p. 54, nymph.
Brachyptera (*Taenionema*) *pallida,* Ricker, 1952, 18: 158.
Taenionema pallida, Illies, 1966, 82: 70.
Taenionema pallidum, Ricker and Ross, 1975, 53: 144.

Type locality. — Little Beaver, Colorado.

Geographic range. — Western United States and Canada.

Distribution in Rocky Mts. — (Canadian, Northern and Southern Rockies): BRITISH COLUMBIA: Kaslo. COLORADO: Boulder Co.; Delta Co.; Gunnison Co.; San Juan Co. MONTANA: Flathead Co.; Lake Co. NEW MEXICO: Taos Co. UTAH: San Juan Co.

Discussion. — This species is very similar to *T. pacifica* and some records may have been confused for these two species in the past. The adults emerge from April to June.

Subfamily Taeniopteryginae

Genus TAENIOPTERYX Pictet 1841

Taeniopteryx is a very common genus in the eastern part of North America. It emerges in the early spring and is easily collected from fence posts and bridges. It is rare in the west and has only been collected from a few scattered localities. Confirmed adults have been assigned to *T. nivalis* but a recent collection of a single nymph from the Pecos River in New Mexico could possibly represent another species.

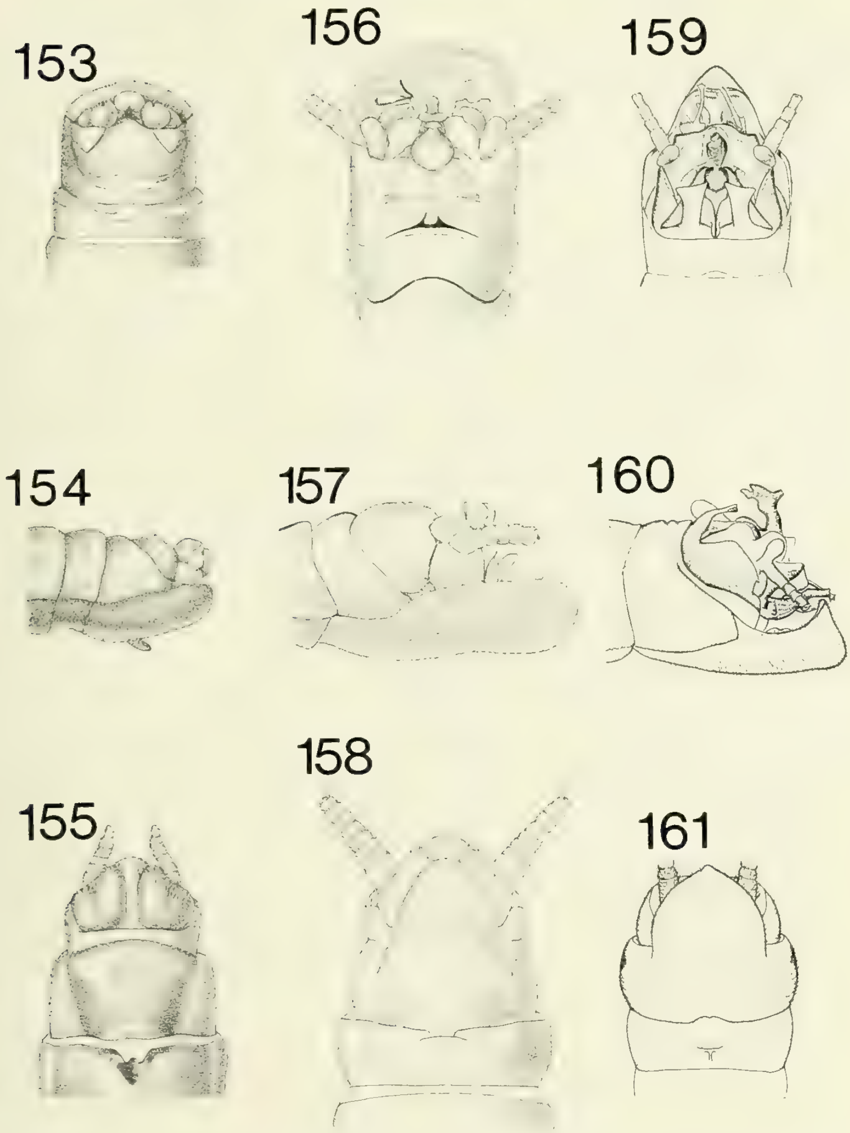
The nymphs possess coxal gills which are able to change in length similar to a telescope. This type of gill is only found in this genus and makes positive identification of even small nymphs possible at the generic level.

Taeniopteryx nivalis (Fitch) (figs. 153-155)

Nemoura nivalis Fitch, 1847, 5: 279.
Taeniopteryx nivalis, Needham and Claassen, 1925 (in part), 2: 240, male and female; figs. 3-4, p. 379, male genitalia; fig. 8, p. 383, female genitalia.
Taeniopteryx nivalis, Ricker and Ross, 1968, 25: 1434.

Type locality. — New York.

Geographic range. — Northern North America.



FIGURES 153-161. — *Taeniopteryx nivalis* (Fitch): 153, male terminalia, dorsal view; 154, male terminalia, lateral view; 155, female terminalia, ventral view. *Oemopteryx fosketti* (Ricker): 156, male terminalia, dorsal view; 157, male terminalia, lateral view; 158, female terminalia, ventral view. *Doddsia occidentalis* (Banks): 159, male terminalia, dorsal view; 160, male terminalia, lateral view; 161, female terminalia, ventral view.

Distribution in Rocky Mts. — (Canadian, Northern and Southern Rockies): ALBERTA: Bigoray River. IDAHO: Adams Co.; Latah Co. NEW MEXICO: Guadalupe Co. (nymph only). OREGON: Baker Co.

Discussion. — This species is common in eastern North America but occurs only rarely in the western Cordillera. The adults emerge in the early spring in March and April.

Family **Capniidae**

The members of this family are small, black stoneflies, mostly less than twelve millimeters in length, whose wings lie flat when at rest. Reduction in wing length is quite common, especially in the males with brachypterous, micropterous and apterous species represented.

Capniidae can be separated in the adult stage from the other families in the Nemouroidea by the presence of long many segmented cerci.

Most species emerge in the winter or early spring which is why they are called the "winter stoneflies." The emerging adults can be extremely abundant in February and they are often found crawling over the snow or on bridge abutments in profusion.

Key to the Genera of Capniidae

Males

1. Vein R_1 of forewings curved upward at origin; A_1 of forewings with distinct downward dip slightly beyond junction cu-a (fig. 295) 2
   Vein R_1 of forewings straight at origin; A_1 of forewings curving gradually downward beyond junction cu-a (fig. 299) 5
2. Ninth sternum with vesicle (fig. 168); size large, length 6 mm or greater .... *Bolshecapnia*
   Ninth sternum without vesicle; size variable but usually smaller than 5 mm 3
3. Epiproct forked, with one process over other in same plane (figs. 251, 252) .... *Utacapnia*
   Epiproct not forked as above 4
4. Epiproct simple, apex with sharply pointed tips (figs. 274-275); abdominal terga not enlarged or modified .... *Mesocapnia*
   Epiproct variable, if simple, one or more abdominal terga enlarged or modified (figs. 174, 175) .... *Capnia*
5. Cerci with fewer than eleven segments .... *Eucapnopsis*
   Cerci with more than eleven segments 6
6. One crossvein in costal area of wings beyond cord (fig. 292) .... *Paracapnia*
   Two or more crossveins in costal area of wings beyond cord (fig. 293) .... *Isocapnia*

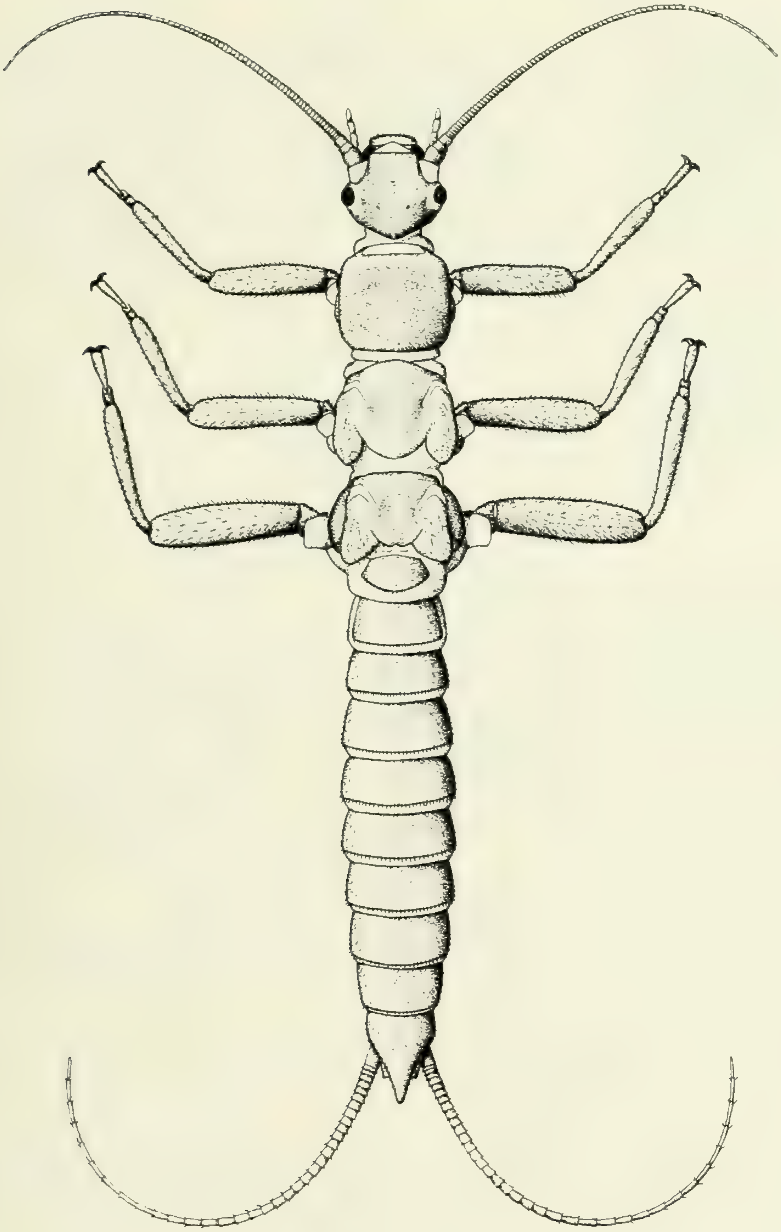


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FIGURE 162. — *Utacapnia lemoniana* (Nebeker and Gaufin), nymph, habitus.

Females

1. Vein R_1 of forewings curved upward at origin; A_1 of forewings with distinct downward dip slightly beyond junction cu-a (fig. 295) 2
   Vein R_1 of forewings curving gradually downward beyond junction cu-a (fig. 294) 4
2. Subgenital plate produced well beyond hind margin of eighth sternum, without distinct sclerotized pattern (fig. 165) .... *Bolshecapnia*
   Subgenital plate usually not produced beyond hind margin of eighth sternum, if produced, subgenital plate exhibits distinct sclerotized pattern 3
3. Subgenital plate enlarged medially, extending slightly over hind margin of eighth sternum, with distinct sclerotized pattern (fig. 265) .... *Utacapnia*
   Subgenital plate not enlarged and not extending over hind margin of eighth sternum, with or without sclerotized pattern (figs. 176, 284) .... *Capnia & Mesocapnia*
4. Cerci with fewer than eleven segments .... *Eucapnopsis*
   Cerci with more than eleven segments 5
5. One crossvein in costal area of wings beyond cord (fig. 292) .... *Paracapnia*
   Two or more crossveins in costal area of wings beyond cord (fig. 293) .... *Isocapnia*

Nymphs

1. Abdominal terga with well developed posterior fringe of long setae, terga with intercalary row of long setae .... *Paracapnia*
   Abdominal terga with posterior fringe of short setae, intercalary setae short or with few scattered long setae not forming definite row 2
2. Cerci with dense fringe of long lateral setae .... *Isocapnia*
   Cerci without fringe of lateral setae 3
3. Lacinia with single weakly sclerotized cusp; average number of cercal segments seventeen .... *Eucapnopsis*
   Lacinia with two or more cusps; average number of cercal segments twenty-five (fig. 162) .... *Bolshecapnia, Capnia, Mesocapnia, Utacapnia*

Genus BOLSHECAPNIA Ricker 1965

This genus is very distinctive in western North America because of its large size and the presence of a vesicle on the ninth sternum of the males (fig. 168).

Some species assigned to this genus by Ricker in 1965 vary considerably in the details of the epiproct but this is also the case in the

FIGURES 163-173. — *Bolshecapnia sasquatchi* (Ricker): 163, male terminalia, dorsal view; 164, male terminalia, lateral view; 165, female terminalia, ventral view. *Bolshecapnia spenceri* (Ricker): 166, male terminalia, dorsal view; 167, male terminalia, lateral view; 168, male terminalia, ventral view; 169, female terminalia, ventral view. *Bolshecapnia milami* (Nebeker and Gaufin): 170, male terminalia, dorsal view; 171, male terminalia, lateral view; 172, female terminalia, ventral view. 173, *Bolshecapnia gregsoni* (Ricker), female terminalia, ventral view.

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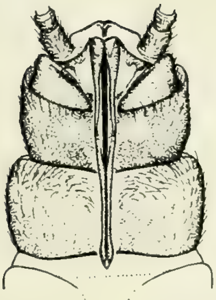

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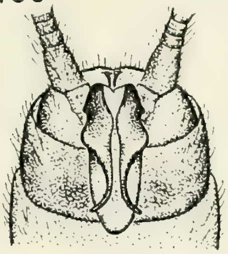

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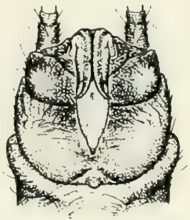

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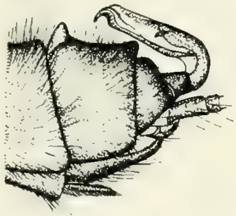

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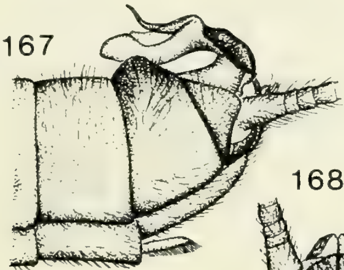

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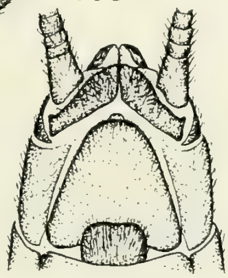

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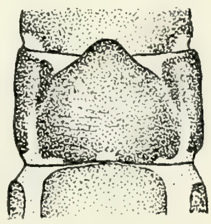

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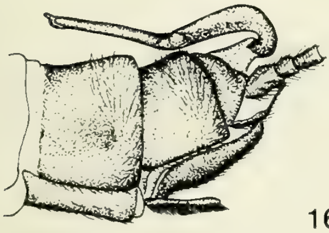

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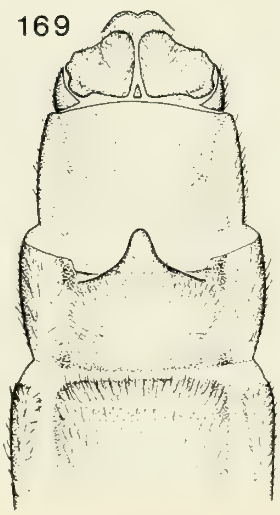

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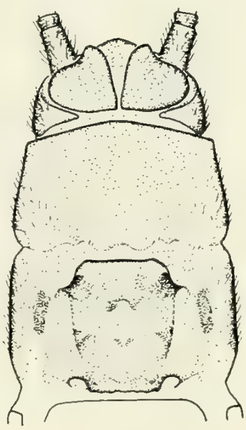

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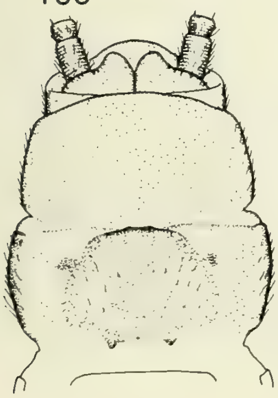

genus Capnia. A revision of the family Capniidae is needed to more completely understand the limits of the genus *Bolshecapnia* on a world wide basis.

It emerges in the early spring at lower elevations but has been collected in the middle of the summer in glacial lakes at high elevations.

Key to the Species of Bolshecapnia

Males

1. Epiproct at least ten times as long as wide, lateral hooks very short and inconspicuous (figs. 163, 164) .... *sasquatchi*
   Epiproct five times as long as wide, lateral hooks long and visible 2
2. Lateral hooks one half length of epiproct, conspicuous and located dorsally 3
   Lateral hooks one fifth length of epiproct, pointing downward and located laterally (figs. 170, 171) .... *milami*
3. Epiproct rounded in lateral view; lobe on ninth tergum large and narrowly rounded at apex (figs. 166, 167) .... *spenceri*
   Epiproct pointed in lateral view; lobe on ninth tergum small and only slightly produced .... *gregsoni*

Females

1. Subgenital plate truncate or broadly rounded at apex 2
   Subgenital plate narrowly rounded at apex 3
2. Subgenital plate wider than long, broadly rounded at apex (fig. 165) .. *sasquatchi*
   Subgenital plate longer than wide, truncate at apex (fig. 172) .... *milami*
3. Subgenital plate narrowly rounded at apex (fig. 173) .... *gregsoni*
   Subgenital plate pointed at apex (fig. 169) .... *spenceri*

Bolshecapnia gregsoni (Ricker) (fig. 173)

Capnia (*Bolshecapnia*) *gregsoni* Ricker, 1965, 22: 479, male, female and nymph; figs. 8-10, p. 480, male and female genitalia.
Bolshecapnia gregsoni, Ricker and Scudder, 1975, 8: 338.

Type locality. — Kokli Lake, Vancouver Island, British Columbia.

Geographic range. — Southern British Columbia.

Distribution in Rocky Mts. — (Canadian Rockies): BRITISH COLUMBIA: Valhalla Mts.; Selkirk Mts.

Discussion. — This rare species has only been collected at or near mountain lakes at high elevations. The adults emerge from April to July.

Bolshecapnia milami (Nebeker and Gaufin) new comb. (figs. 170-172)

Capnia milami Nebeker and Gaufin, 1967c, 93: 235, male and female; figs. 20-21, p. 245, male genitalia.

Type locality. — Lion Creek, Lake Co., Montana.

Geographic range. — Rocky Mts.

Distribution in Rocky Mts. — (Canadian and Northern Rockies): ALBERTA: Banff N. P. IDAHO: Blaine Co. MONTANA: Flathead Co.; Lake Co.

Discussion. — This rare species occurs in creeks and rivers. The adults have only been collected in March.

Bolshecapnia sasquatchi (Ricker) (figs. 163-165)

Capnia (Bolshecapnia) sasquatchi Ricker, 1965, 22: 482, male; figs. 17-18, p. 483, male genitalia.

Capnia sasquatchi, Nebeker and Gaufin, 1967c, 93: 243, female; fig. 18, p. 245, female genitalia.

Bolshecapnia sasquatchi, Ricker and Scudder, 1975, 8: 338.

Type locality. — Fraser River Bridge, near Agassiz, British Columbia.

Geographic range. — Cascade and Rocky Mts.

Distribution in Rocky Mts. — (Canadian and Northern Rockies): ALBERTA: Banff N. P. MONTANA: Flathead Co.; Lake Co.; Missoula Co.

Discussion. — This rare species occurs in both creeks and rivers. The adults emerge in March.

Bolshecapnia spenceri (Ricker) (figs. 166-169)

Capnia (Bolshecapnia) spenceri Ricker, 1965, 22: 481, male and female; figs. 11-16, p. 480, male and female genitalia.

Bolshecapnia spenceri, Ricker and Scudder, 1975, 8: 338.

Type locality. — Consolation Lake, Banff N. P., Alberta.

Geographic range. — Rocky Mts.

Distribution in Rocky Mts. — (Canadian and Northern Rockies): ALBERTA: Banff N. P. BRITISH COLUMBIA: Selkirk Mts. MONTANA: Flathead Co.; Glacier Co.

Discussion. — This species occurs in creeks and rivers and is one of the few stoneflies to occur in lakes. It is found abundantly in Iceberg Lake, Glacier N. P. The adults emerge from late June to early August.

Genus CAPNIA Pictet 1841

This genus is comprised of small, black species most of which are less than ten millimeters in length. The cerci are as long as or longer than the entire body. The male epiproct is long and recurved over the abdomen in the form of a probe (fig. 184). The male ninth sternum is usually modified or produced (fig. 175).

Capnia contains a large number of species and species complexes. When the genus is studied in more detail it is quite likely that it will be divided into several taxonomic units.

Key to the Species of Capnia

Males

(*venosa* unknown)

1. Epiproct short, not more than three times as long as wide, usually expanded medially ... 2
   Epiproct long, five or more times longer than wide, often as much as ten times ... 8
2. Conspicuous hook-like projections on terga six to eight (figs. 220, 221) ... *sextuberculata*
   Projections absent from tergum six ... 3
3. Conspicuous hump or projection on tergum seven (fig. 175) ... 4
   Tergum seven not modified; eighth or ninth terga sometimes modified (fig. 224) ... 5
4. Epiproct broad medially, tapering to pointed apex (figs. 174, 175) ... *barbata*
   Epiproct broad throughout, tapering only slightly to rounded, bilobed apex (fig. 201) ... *decepta*
5. Conspicuous hump on tergum eight (fig. 178) ... 6
   Tergum eight without hump (fig. 215) ... 7
6. Epiproct with broad shield-like median portion; hump on tergum eight large and bilobed (figs. 223, 224) ... *uintahi*
   Epiproct narrow medially; hump on tergum eight, with single narrow lobe (figs. 177, 178) ... *cheama*
7. Tergum nine with two projections located along lateral margins (fig. 197) ... *californica*
   Tergum nine unmodified (figs. 214, 215) ... *nedia*
8. Epiproct about five times longer than wide (fig. 227) ... 9
   Epiproct about ten times longer than wide (fig. 181) ... 11
9. Epiproct flattened dorsoventrally; no humps on abdominal terga (figs. 226, 227) ... *utahensis*
   Epiproct not flattened dorsoventrally; hump on abdominal terga seven or eight ... 10
10. Conspicuous hump on tergum eight (fig. 212) ... *nana*
    Conspicuous hump on tergum seven (figs. 206, 207) ... *fibula*
11. Conspicuous hump on tergum eight; apex of epiproct with distinctive downward pointed apex (figs. 180, 181) ... *coloradensis*
    Hump absent from tergum eight sometimes present on tergum seven (figs. 198, 199) ... 12
12. Conspicuous hump on tergum seven (fig. 230) ... 13
    Abdominal terga without humps or projections (fig. 195) ... 17
13. Wings short, not reaching beyond middle of abdomen ... 14
    Wings longer than abdomen ... 15
14. Epiproct with large triangular-shaped apex in lateral view (fig. 199) ... *cygna*
    Epiproct tapering gradually to narrow apex in lateral view (fig. 230) ... *wanica*
15. Epiproct almost straight in lateral view, apex pointing distinctly downward (fig. 218) ... *petila*
    Epiproct gently S-shaped in lateral view, apex parallel to body axis (fig. 190) ... 16

16. Epiproct round in cross section, equal width throughout length, long and delicate; low hump on sternum seven (fig. 190) .... *gracilaria*
Epiproct oval in cross section, enlarged medially; large hump on sternum seven (fig. 204) .... *elongata* *
17. Wings short, not reaching to middle of abdomen .... *lineata*
Wings long, reaching beyond tip of abdomen 18
18. Epiproct with anterior portion distinctly bent to one side in dorsal view (figs. 186, 187) .... *glabra* *
Epiproct straight throughout length in dorsal view 19
19. Epiproct fairly uniform in width throughout length, not distinctly narrower or bent downward at tip (figs. 183, 184) .... *confusa*
Epiproct broader at base than near apex, anterior third narrow and bent downward at tip (figs. 192, 193) .... *vernalis*

Females

(*nedia* unknown)

1. Seventh and eighth sterna united by median sclerotized band of varying widths (fig. 194) 2
Seventh and eighth sterna not united but separated by membranous area (fig. 231) 6
2. Connection between seventh and eighth sterna narrow; posterior margin of eighth sternum with triangular membranous area (fig. 194) .... *vernalis*
Connection between seventh and eighth sterna broad; posterior margin of eighth sternum completely sclerotized (fig. 219) 3
3. Median sclerotized portion of eighth sternum as long as wide 4
Median sclerotized portion of eighth sternum twice as long as wide 5
4. Posterior margin of eighth sternum broadly triangular; small species (5 mm) (fig. 219) .... *petila*
Posterior margin of eighth sternum truncate or bluntly rounded; medium species (8 mm) (fig. 176) .... *barbata*
5. Sclerotized posterior margin of eighth sternum narrow and rounded (fig. 182) .... *coloradensis*
Sclerotized posterior margin of eighth sternum broad and truncate (fig. 205) .... *elongata* *
6. Most of eighth sternum membranous, but with narrow median Y-shaped sclerotized pattern (fig. 231) .... *wanica*
Most of eighth sternum sclerotized 7
7. Posterior margin of seventh sternum mostly membranous, with narrow median sclerotized pattern extending to eighth sternum (fig. 185) .... *confusa*
Posterior margin of seventh sternum uniformly sclerotized 8
8. Subgenital plate with conspicuous median pigmentation (fig. 213) 9
Subgenital plate mostly uniformly pigmented (fig. 225) 14
9. Darkly sclerotized median portion of subgenital plate somewhat V-shaped, the point of the "V" directed anteriorly (fig. 188) 10
Darkly sclerotized median portion of subgenital plate rectangular and large or hourglass-shaped and inconspicuous (fig. 222) 11

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* Signifies species not presently known from the Rocky Mountains.

10. Posterior median sclerotized portion of subgenital plate slightly produced, forming narrow dark triangle (fig. 188) .... *glabra* *
    Posterior median sclerotized portion of subgenital plate slightly recessed, forming broad inconspicuous triangle (fig. 213) .... *nana*
11. Median sclerotized pattern on subgenital plate hourglass-shaped and inconspicuous, posterior margin of eighth sternum rounded (fig. 222) .... *sextuberculata*
    Median sclerotized pattern on subgenital plate rectangular and apparent, posterior margin of eighth sternum straight or truncate (fig. 228) 12
12. Posterior margin of eighth sternum forming small truncate flap, sclerotized median area not distinct 13
    Posterior margin of eighth sternum slightly rounded but not forming a flap, sclerotized median area dark and distinct (fig. 228) .... *utahensis* and *californica*
13. Subgenital plate short and broad, posterior flap with narrow truncate apex (fig. 179) .... *cheama*
    Subgenital plate long and narrow, posterior flap with broad truncate apex (fig. 191) .... *gracilaria*
14. Posterior margin of subgenital plate recessed (fig. 225) .... *uintahi*
    Posterior margin of subgenital plate straight and not recessed 15
15. Posterior margin of subgenital plate with lateral membranous areas, flanking straight median sclerotized pattern (fig. 196) .... *lineata*
    Posterior margin of subgenital plate entirely sclerotized 16
16. Posterior margin of subgenital plate slightly indented (fig. 200) .... *cygna*
    Posterior margin of subgenital plate straight or rounded 17
17. Forewing with crossveins beyond cord .... *venosa*
    Forewing without crossveins beyond cord 18
18. Posterior median portion of subgenital plate with broadly stalked T-shaped pattern, with inconspicuous dorsal line (fig. 208) .... *fibula*
    Posterior median portion of subgenital plate entirely sclerotized (fig. 202) .... *decepta*

Capnia barbata Frison (figs. 174-176)

Capnia barbata Frison, 1944, 69: 153, male and female; figs. 2a-2c, p. 157, male and female genitalia.

Type locality. — Little Thompson River, north of Longmont, Colorado.

Geographic range. — Colorado and Arizona.

Distribution in Rocky Mts. — (Southern Rockies): ARIZONA: Apache Co.; Cochise Co.; Coconino Co.; Gila Co.; Pima Co. COLORADO: Arapahoe Co.; Boulder Co.; Larimer Co.

Discussion. — This species is found in creeks and small rivers. The adults emerge from February to early May.

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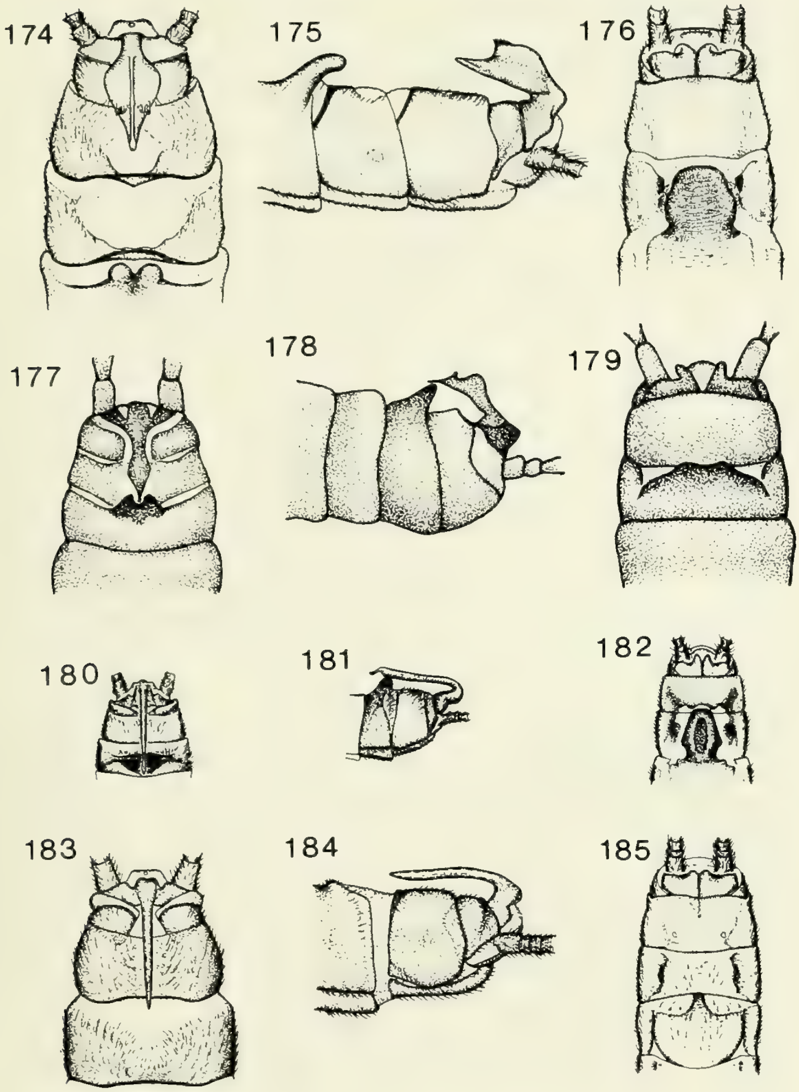
* Signifies species not presently known from the Rocky Mountains.



FIGURES 174-185. — *Capnia barbata* Frison: 174, male terminalia, dorsal view; 175, male terminalia, lateral view; 176, female terminalia, ventral view. *Capnia cheama* Ricker: 177, male terminalia, dorsal view; 178, male terminalia, lateral view; 179, female terminalia, ventral view. *Capnia coloradensis* Claassen: 180, male terminalia, dorsal view; 181, male terminalia, lateral view; 182, female terminalia, ventral view. *Capnia confusa* Claassen: 183, male terminalia, dorsal view; 184, male terminalia, lateral view; 185, female terminalia, ventral view.

Capnia californica Claassen (fig. 197)

Capnia californica Claassen, 1924, 56: 57, male.
Capnia californica, Needham and Claassen, 1925, 2: 262, male; fig. 11, p. 386, male genitalia.
Capnia californica, Jewett, 1954, p. 175, female; fig. 6, p. 173, female genitalia.

Type locality. — Cazadero, California.

Geographic range. — California and Arizona.

Distribution in Rocky Mts. — (Southern Rockies): ARIZONA: Cochise Co.; Pima Co.; Santa Cruz Co.

Discussion. — Found in small often intermittent creeks. It emerges from January to April.

Capnia cheama Ricker (figs. 177-179)

Capnia cheama Ricker, 1965, 22: 484, male and female; figs. 23-25, p. 486, male and female genitalia.

Type locality. — Fraser River, Agassiz, British Columbia.

Geographic range. — Cascade and Rocky Mts.

Distribution in Rocky Mts. — (Canadian and Northern Rockies): ALBERTA: Banff N. P. MONTANA: Flathead Co.; Lincoln Co.

Discussion. — This rare species has only been collected in large rivers. The adults emerge from March to early May.

Capnia coloradensis Claassen (figs. 180-182)

Capnia coloradensis Claassen, 1937a, 69: 79, male; (female described not *coloradensis*).
Capnia coloradensis, Ricker, 1965, 22: 487, male and female; figs. 30-32, p. 491, male and female genitalia.

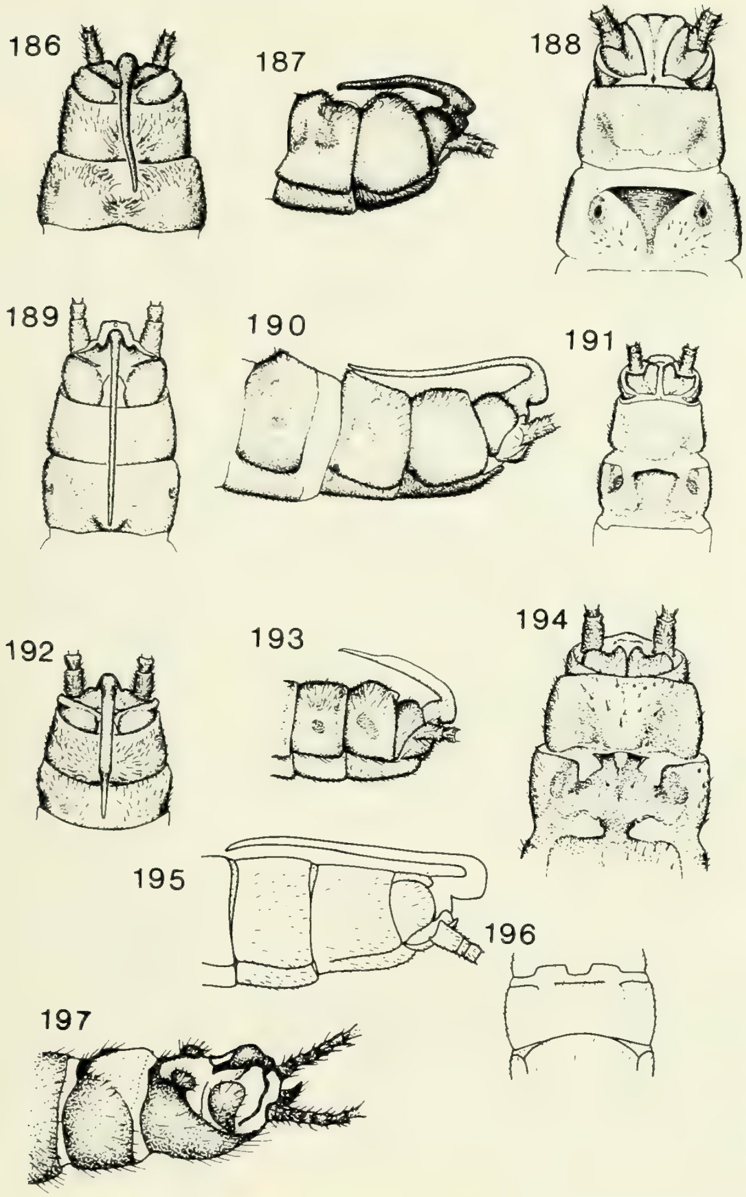
Type locality. — Seven Falls, N. Cheyenne Canyon, Colorado.

Geographic range. — Rocky Mts.

Distribution in Rocky Mts. — (Northern, Central and Southern Rockies): COLORADO: El Paso Co.; Grand Co.; Gunnison Co.; Hinsdale Co.; Lake Co.; Routt Co.; San Juan Co. IDAHO: Adams Co.; Benewah Co.; Blaine Co.; Bonner Co.; Bonneville Co.; Custer Co.; Fremont Co.; Latah Co.; Teton Co.; Valley Co. MONTANA: Broadwater Co.; Gallatin Co. WYOMING: Albany Co.; Lincoln Co.; Park Co.; Sublette Co.

Discussion. — This species is common in creeks and rivers. The adults emerge in March and April.

FIGURES 186-197. — *Capnia glabra* Claassen: 186, male terminalia, dorsal view; 187, male terminalia, lateral view; 188, female terminalia, ventral view. *Capnia gracilaria* Claassen: 189, male terminalia, dorsal view; 190, male terminalia, lateral



view; 191, female terminalia, ventral view. *Capnia vernalis* (Newport): 192, male terminalia, dorsal view; 193, male terminalia, lateral view; 194, female terminalia, ventral view. *Capnia lineata* Hanson: 195, male terminalia, lateral view; 196, female terminalia, ventral view. 197, *Capnia californica* Claassen, male terminalia, lateral view.

Capnia confusa Claassen (figs. 183-185)

Capnia nivalis Neave, 1929, 4: 163, male and female; figs. 11-12, pl. 1, male and female genitalia.
Capnia confusa Claassen, 1936, 29: 623.
Capnia ligulata Hanson, 1943c, 45: 85.

Type locality. — Maligne Lake, Alberta.

Geographic range. — Coast, Cascade and Rocky Mts.

Distribution in Rocky Mts. — (Canadian, Northern, Central and Southern Rockies): ALBERTA: Banff N. P.; Jasper N. P. BRITISH COLUMBIA: Penticton; Summit Lake. COLORADO: Chaffee Co.; Eagle Co.; Garfield Co.; Grand Co.; Gunnison Co.; Hinsdale Co.; La Plata Co.; Larimer Co.; Montezuma Co.; Ouray Co.; Pitkin Co.; Routt Co.; Summit Co. IDAHO: Adams Co.; Bannock Co.; Bear Lake Co.; Blaine Co.; Bonneville Co.; Custer Co.; Franklin Co.; Fremont Co.; Idaho Co.; Lake Co.; Valley Co. MONTANA: Cascade Co.; Flathead Co.; Gallatin Co.; Glacier Co.; Granite Co.; Lake Co.; Lincoln Co.; Mineral Co.; Missoula Co.; Park Co.; Ravalli Co. NEW MEXICO: Rio Arriba Co.; Sandoval Co.; San Miguel Co.; Taos Co. UTAH: Beaver Co.; Box Elder Co.; Cache Co.; Carbon Co.; Daggett Co.; Iron Co.; Salt Lake Co.; Sevier Co.; Summit Co.; Utah Co.; Wasatch Co.; Weber Co. WYOMING: Albany Co.; Fremont Co.; Lincoln Co.; Park Co.; Platte Co.; Sublette Co.; Teton Co.

Discussion. — This species occurs commonly in creeks, with the adults emerging from February to June.

Capnia cygna Jewett (figs. 198-200)

Capnia cygna Jewett, 1954, 11: 546, male; fig. 6, p. 544, male genitalia.
Capnia cygna, Baumann, 1973, 33: 92, female; fig. 2, p. 94, female genitalia.

Type locality. — Washington.

Geographic range. — Coast, Cascade and Rocky Mts.

Distribution in Rocky Mts. — (Northern and Central Rockies): IDAHO: Blaine Co.; Latah Co. MONTANA: Dawson Co. UTAH: Davis Co. WASHINGTON: Whitman Co.

Discussion. — This rare species is found in creeks. Adults have been collected from February in Utah to early May in Idaho.

FIGURES 198-208. — *Capnia cygna* Jewett: 198, male terminalia, dorsal view; 199, male terminalia, lateral view; 200, female terminalia, ventral view. *Capnia decepta* (Banks): 201, male terminalia, lateral view; 202, female terminalia, ventral view. *Capnia elongata* Claassen: 203, male terminalia, dorsal view; 204, male terminalia,

198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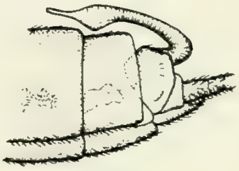

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201


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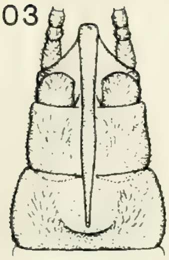

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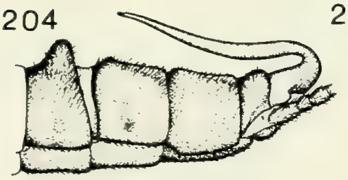

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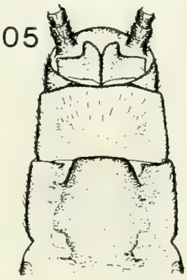

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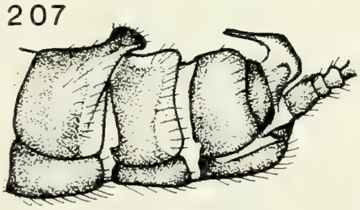

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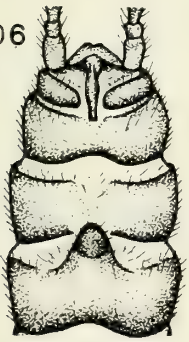

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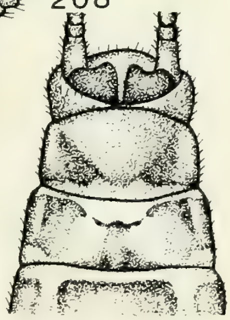

lateral view; 205, female terminalia, ventral view. *Capnia fibula* Claassen: 206, male terminalia, dorsal view; 207, male terminalia, lateral view; 208, female terminalia, ventral view.

Capnia decepta (Banks) (figs. 201, 202)

Arsapnia decepta Banks, 1897, 24: 22.
Capnia decepta, Needham and Claassen, 1925, 2: 264, male and female; figs. 4-5, p. 389, male and female genitalia.

Type locality. — Colorado.

Geographic range. — Colorado.

Distribution in Rocky Mts. — (Southern Rockies): COLORADO: Boulder Co.; Larimer Co.; Routt Co.

Discussion. — It is found in small creeks and the adults emerge in May.

Capnia fibula Claassen (figs. 206-208)

Capnia fibula Claassen 1924, 56: 55, male and female.
Capnia fibula, Hanson, 1946, 35: 230; figs. 57-58, p. 247, male genitalia.

Type locality. — Las Vegas Hot Springs, New Mexico.

Geographic range. — Arizona and New Mexico.

Distribution in Rocky Mts. — (Southern Rockies): ARIZONA: Coconino Co., West Fork Oak Creek. NEW MEXICO: San Miguel Co., Las Vegas Hot Springs.

Discussion. — This rare species is known only from the two above localities. It emerges from January to March.

Capnia gracilaria Claassen (figs. 189-191)

Capnia gracilaria Claassen, 1924, 56: 57, male.
Capnia gracilaria, Needham and Claassen, 1925, 2: 258, male; fig. 5, p. 387, male genitalia.
Capnia gracilaria, Ricker, 1943, 12: 99, female and nymph; fig. 82, p. 101, female genitalia.

Type locality. — Aweme, Manitoba.

Geographic range. — Coast, Cascade and Rocky Mts. and Northern Great Plains.

Distribution in Rocky Mts. — (Canadian, Northern, Central and Southern Rockies): ALBERTA: Banff N. P. COLORADO: Archuleta Co.; Clear Creek Co.; Gunnison Co.; Hinsdale Co.; Lake Co.; La Plata Co.; Montrose Co.; Ouray Co.; Routt Co. IDAHO: Adams Co.; Bannock Co.; Blaine Co.; Boise Co.; Bonner Co.; Bonneville Co.; Boundary

FIGURES 209-219. — *Capnia nana wasatchae* Nebeker and Gaufin: 209, male terminalia, dorsal view; 210, male terminalia, lateral view; 211, female terminalia, ventral view. *Capnia nana nana* Claassen: 212, male terminalia, dorsal view; 213, female terminalia, ventral view. *Capnia nedia* Nebeker and Gaufin: 214, male

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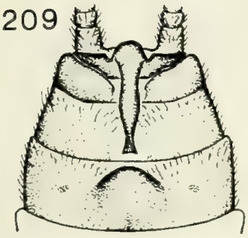

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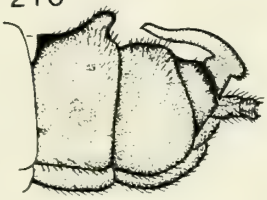

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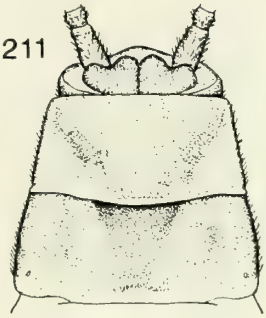

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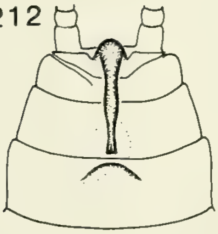

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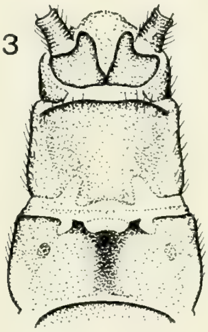

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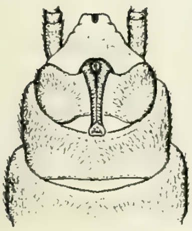

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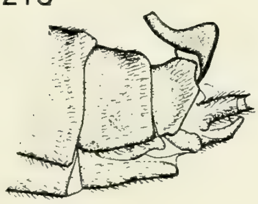

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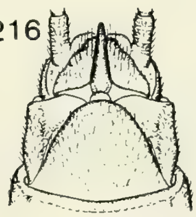

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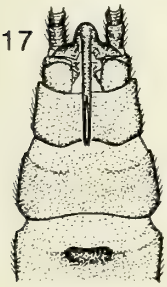

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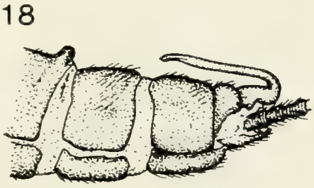

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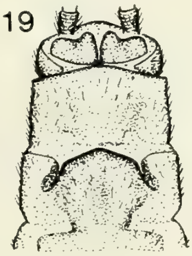


terminalia, dorsal view; 215, male terminalia, lateral view; 216, male terminalia, ventral view. *Capnia petila* Jewett: 217, male terminalia, dorsal view; 218, male terminalia, lateral view; 219, female terminalia, ventral view.

Co.; Custer Co.; Franklin Co.; Fremont Co.; Idaho Co.; Jefferson Co.; Latah Co.; Lemhi Co.; Shoshone Co.; Teton Co.; Valley Co. MONTANA: Broadwater Co.; Flathead Co.; Gallatin Co.; Lake Co.; Lewis and Clark Co.; Lincoln Co.; Missoula Co.; Park Co.; Ravalli Co. NEW MEXICO: Santa Fe Co.; Taos Co. OREGON: Baker Co. UTAH: Beaver Co.; Cache Co.; Daggett Co.; Davis Co.; Duchesne Co.; Iron Co.; Kane Co.; Millard Co.; Morgan Co.; Salt Lake Co.; Sevier Co.; Summit Co.; Tooele Co.; Utah Co.; Wasatch Co.; Washington Co.; Weber Co. WYOMING: Albany Co.; Lincoln Co.; Park Co.; Sublette Co.; Teton Co.

Discussion. — This species occurs abundantly in creeks and small rivers. The adults emerge from January to May.

Capnia lineata Hanson (figs. 195, 196)

Capnia lineata Hanson, 1943c, 45: 85, male and female; figs. 2-3, p. 87, male and female genitalia.
Capnia zukeli Hanson, 1943c, 45: 86, male and female **(new synonymy).**

Type locality. — Troy, Idaho.

Geographic range. — Idaho, California.

Distribution in Rocky Mts. — (Northern Rockies): IDAHO: Latah Co.: Troy; Big Bear Cr.; West Fk. Little Bear Cr.; Moscow.

Discussion. — This rare species occurs in creeks in northern Idaho. The adults emerge in March and April.

Capnia nana Claassen (figs. 209-213, 304)

Capnia nana Claassen, 1924, 56: 46, male.
Capnia nana, Needham and Claassen, 1925, 2: 257, male; fig. 3, p. 387, male genitalia.
Capnia nana, Frison, 1942a, 18: 66, female; fig. 11, p. 67, female genitalia.
Capnia nana wasatchae Nebeker and Gaufin, 1967c, 93: 240.

Type locality. — Terrace, British Columbia.

Geographic range. — Coast, Cascade and Rocky Mts.

Distribution in Rocky Mts. — (Canadian, Northern, Central and Southern Rockies): ALBERTA: Banff N. P. COLORADO: Gunnison Co. IDAHO: Bannock Co.; Bonneville Co.; Franklin Co. MONTANA: Flathead Co.; Gallatin Co.; Lake Co.; Ravalli Co. OREGON: Baker Co. UTAH: Cache Co.; Davis Co.; Salt Lake Co.; Summit Co.; Utah Co.; Wasatch Co.; Weber Co. WYOMING: Lincoln Co.

Discussion. — Nebeker and Gaufin (1967) identified a northern and a southern subspecies of *Capnia nana,* but these subspecies are not separated in this paper. This species occurs commonly in cold springs and streams. The adults emerge from November to May.

Capnia nedia Nebeker and Gaufin (figs. 214-216)

Capnia nedia Nebeker and Gaufin, 1966a, 77: 36, male; figs. 1-3, p. 41, male genitalia.

Type locality. — Sand Creek, Boise, Boise Co., Idaho.

Geographic range. — Idaho.

Distribution in Rocky Mts. — (Northern Rockies): IDAHO: Boise Co.

Discussion. — This rare species is only known from the holotype, which is a mature male nymph collected in April.

Capnia petila Jewett (figs. 217-219)

Capnia petila Jewett, 1954, 11: 546, male; fig. 7, p. 544, male genitalia.
Capnia petila, Nebeker and Gaufin, 1967c, 93: 238, female; figs. 5-7, p. 237, male and female genitalia.

Type locality. — Spring Creek, tributary to Powder River, Baker Co., Oregon.

Geographic range. — Cascade and Rocky Mts.

Distribution in Rocky Mts. — (Canadian, Northern and Central Rockies): ALBERTA: Banff N. P. IDAHO: Bonneville Co. MONTANA: Broadwater Co.; Flathead Co.; Lake Co.; Missoula Co.; Ravalli Co. OREGON: Baker Co. WYOMING: Sublette Co.

Discussion. — This species is found in creeks and rivers. The adults emerge from late February to May.

Capnia sextuberculata Jewett (figs. 220-222)

Capnia sextuberculata Jewett, 1954, 22: 547, male; fig. 5, p. 544, male genitalia.
Capnia sextuberculata, Nebeker and Gaufin, 1967c, 93: 239, female; figs. 8-10, p. 237, male and female genitalia.

Type locality. — Spring Creek, tributary to Powder River, Baker Co., Oregon.

Geographic range. — Coast and Rocky Mts.

Distribution in Rocky Mts. — (Canadian and Northern Rockies): ALBERTA: Banff N. P. MONTANA: Flathead Co.; Lake Co.; Missoula Co.

Discussion. — This species is common in rivers and creeks, particularly in Montana. The adults emerge from late February to April.

Capnia uintahi Gaufin (figs. 35, 223-225)

Capnia uintahi Gaufin, 1964b, 22: 307, male and female; fig. 1, p. 308, male and female genitalia.

Type locality. — Provo River, Wasatch Co., Utah.

Geographic range. — Rocky Mts.

Distribution in Rocky Mts. — (Central Rockies): IDAHO: Bannock Co.; Bonneville Co.; Franklin Co.; Oneida Co. UTAH: Davis Co.; Salt Lake Co.; Summit Co.; Wasatch Co. WYOMING: Lincoln Co.

Discussion. — This species, which occurs in creeks and rivers, is both rare and restricted in its distribution. The adults emerge from February to April.

Capnia utahensis Gaufin and Jewett (figs. 226-228)

Capnia utahensis Gaufin and Jewett, 1962, 20: 69, male and female; fig. 1, p. 70, male and female genitalia.

Type locality. — Beaver Creek, Beaver Co., Utah.

Geographic range. — Central and Southern Utah.

Distribution in Rocky Mts. — (Southern Rockies): UTAH: Beaver Co.; Iron Co.; Millard Co.; Sevier Co.; Utah Co.; Washington Co.

Discussion. — This species occurs in streams. The adults have been collected from late January to April.

Capnia venosa (Banks)

Capnura venosa Banks, 1900a, 26: 245, female.

Capnura venosa, Needham and Claassen, 1925, 2: 270, female; fig. 7, p. 385, female genitalia.

Capnia venosa, Hanson, 1946, 35: 239.

Type locality. — Pullman, Washington.

Geographic range. — Oregon and Washington.

Distribution in Rocky Mts. — (Northern Rockies): WASHINGTON: Whitman Co.

Discussion. — The male of this species is presently unknown although the female was described over seventy-five years ago. The record for Oregon was found in Jewett (1959) but is unconfirmed. Adult females have been recorded from the months of March and April.

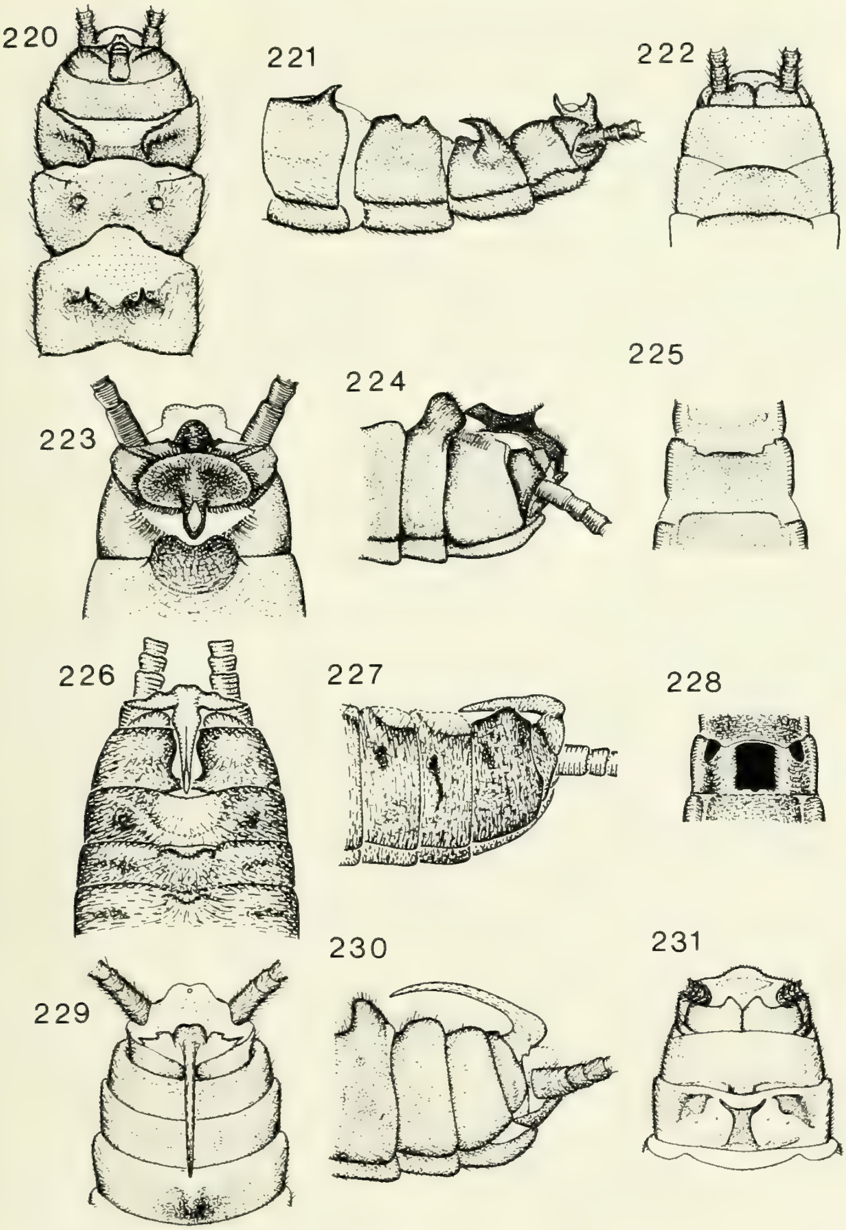
Capnia vernalis Newport (figs. 192-194)

Capnia vernalis Newport, 1848, 1: 451, male.

Capnia limata Frison, 1944, 69: 155, male and female; figs. 3a-3c, p. 157, male and female genitalia.

Capnia vernalis, Baumann, 1973, 33: 93.

FIGURES 220-231. — *Capnia sextuberculata* Jewett: 220, male terminalia, dorsal view; 221, male terminalia, lateral view; 222, female terminalia, ventral view. *Capnia uintahi* Gaufin: 223, male terminalia, dorsal view; 224, male terminalia, lateral



view; 225, female terminalia, ventral view. *Capnia utahensis* Gaufin and Jewett: 226, male terminalia, dorsal view; 227, male terminalia, lateral view; 228, female terminalia, ventral view. *Capnia wanica* Frison: 229, male terminalia, dorsal view; 230, male terminalia, lateral view; 231, female terminalia, ventral view.

Type locality. — Albany River, Ontario.

Geographic range. — Northern North America.

Distribution in Rocky Mts. — (Canadian, Northern, Central and Southern Rockies): ALBERTA: Banff N. P. COLORADO: Arapahoe Co.; Archuleta Co.; Chaffee Co.; Conejos Co.; Grand Co.; Gunnison Co.; Moffat Co.; Montrose Co.; Pueblo Co.; Routt Co. IDAHO: Benewah Co.; Power Co. MONTANA: Broadwater Co.; Cascade Co.; Gallatin Co. UTAH: Cache Co.; Duchesne Co.; Garfield Co.; Sevier Co.; Uintah Co.; Utah Co. WYOMING: Platte Co.; Uinta Co.

Discussion. — This species can be abundant in large somewhat warmer rivers. The adults emerge from February to early April.

Capnia wanica Frison (figs. 229-231)

Capnia wanica Frison, 1944, 69: 151, male and female; figs. 1a-1c, p. 157, male and female genitalia.

Type locality. — Little Thompson River, north of Longmont, Colorado.

Geographic range. — Rocky Mts.

Distribution in Rocky Mts. — (Central and Southern Rockies): COLORADO: Arapahoe Co.; Boulder Co.; Douglas Co. UTAH: Beaver Co.; Iron Co.; Sevier Co.; Washington Co. WYOMING: Platte Co.

Discussion. — This species occurs in creeks and rivers. The adults emerge from late February to April.

Genus EUCAPNOPSIS Okamoto 1923

This genus is characterized by having fewer than eleven segments in each cercus. This is unique in the family Capniidae which commonly exhibits very long, many segmented cerci. The wings are usually a dull grey-black shade when compared to most of the capniids which have shiny black wings.

The single North American species, *Eucapnopsis brevicauda,* is most easily collected by sorting through streamside debris in the early spring.

Eucapnopsis brevicauda (Claassen) (figs. 248-250, 294)

Capnia brevicauda Claassen, 1924, 56: 55, female.
Capnia brevicauda, Needham and Claassen, 1925, 2: 269, female; fig. 12, p. 367, female genitalia.
Eucapnopsis brevicauda, Neave, 1934, 66: 6, male; figs. 8-9, p. 3, male genitalia.

Type locality. — Boulder, Colorado.

Geographic range. — Coast, Cascade, Rocky and Sierra Nevada Mts.

Distribution in Rocky Mts. — (Canadian, Northern, Central and

Southern Rockies): ALBERTA: Banff N. P.; Waterton Lakes N. P. BRITISH COLUMBIA: Campbell Creek, Purcell Range. ARIZONA: Apache Co.; Cochise Co. COLORADO: Boulder Co.; Eagle Co.; Garfield Co.; Grand Co.; Gunnison Co.; Routt Co.; Summit Co. IDAHO: Bannock Co.; Blaine Co.; Bonner Co.; Bonneville Co.; Franklin Co.; Fremont Co.; Idaho Co.; Latah Co.; Lemhi Co.; Lewis Co.; Nez Perce Co.; Shoshone Co. MONTANA: Carbon Co.; Cascade Co.; Flathead Co.; Gallatin Co.; Glacier Co.; Granite Co.; Lake Co.; Lewis and Clark Co.; Lincoln Co.; Mineral Co.; Missoula Co.; Powell Co.; Ravalli Co.; Sweet Grass Co. NEW MEXICO: Santa Fe Co.; Taos Co. UTAH: Cache Co.; Daggett Co.; Davis Co.; Piute Co.; Salt Lake Co.; Tooele Co.; Utah Co.; Wasatch Co.; Weber Co. WYOMING: Albany Co.; Park Co.

Discussion. — This species is abundant in both creeks and rivers throughout its range. The adults emerge from February to July.

Genus ISOCAPNIA Banks 1938

The genus *Isocapnia* is of particular interest because of its rarity and because of the large size of most species as compared to other capniids. The known nymphs are distinctive in having a fringe of long swimming hairs running along the cerci. The most interesting feature of the adults is the occurrence of dwarf males in certain species. Such males are characterized by smaller size and very reduced wings. In species which have long-winged males as well as dwarf ones, the former show no tendency toward wing reduction or integradation with the dwarf forms.

Key to the Species of Isocapnia

Males

1. Length of forewings 7-7.5 mm; epiproct short and slender (figs. 240, 241) .... *vedderensis*
   Length of forewings 9-16 mm; epiproct long and slender 2
2. Ninth tergum with prominent notched or bilobed process on posterior margin .. 3
   Ninth tergum without raised process 5
3. Epiproct stout and strongly recurved (fig. 238) .... *hyalita*
   Epiproct narrow and almost straight 4
4. Epiproct uniformly slender from base to apex (fig. 237) .... *missourii*
   Epiproct thicker at base and narrower near apex (fig. 239) .... *integra*
5. Epiproct very narrow and slightly S-shaped in lateral view, tip simple (figs. 234, 235) .... *grandis*
   Epiproct broader and slightly arched in lateral view, tip with small hook (figs. 232, 233) .... *crinita*

Females

1. Length of forewings 7-9 mm; eighth sternum completely membranous medially, bordered laterally by large sclerotized lateral areas (fig. 244) .... *vedderensis*
   Length of forewings 10-20 mm; eighth sternum entirely sclerotized or with narrow sclerotized medial tongue 2
2. Costal crossveins one to four (rarely five) before end of Sc, and none to two beyond; eighth sternum lacking sclerotized tongue 3
   Costal crossveins four to eight before end of Sc, and two to four beyond; eighth sternum with median sclerotized tongue 5
3. Costal crossveins four or five before tip of Sc; subgenital plate moderately recessed medially (fig. 246) .... *hyalita*
   Costal crossveins three or fewer before tip of Sc; subgenital plate only slightly recessed 4
4. Subgenital plate completely dark (fig. 247) .... *missourii*
   Subgenital plate with light median area bordered by dark lateral areas (fig. 245) .... *integra*
5. Subgenital plate with short median darkly sclerotized tongue, lateral sclerotized patches as triangles on dark background (fig. 243) .... *grandis*
   Subgenital plate with long median lightly sclerotized tongue, lateral sclerotized patches as elongate spots of darker pigment (fig. 242) .... *crinita*

Isocapnia crinita (Needham and Claassen) (figs. 232, 233, 242)

Capnia crinita Needham and Claassen, 1925, 2: 269, female; fig. 6, p. 357, wings.
Isocapnia crinita, Ricker, 1959, 37: 643, male and female; figs. 2-3, 7, p. 646, male and female genitalia.

Type locality. — Bozeman, Montana.

Geographic range. — Rocky Mts.

Distribution in Rocky Mts. — (Northern, Central and Southern Rockies): COLORADO: Gunnison Co. IDAHO: Franklin Co.; Jefferson Co. MONTANA: Flathead Co.; Gallatin Co. UTAH: Cache Co.; Wasatch Co.; Weber Co.; Utah Co.; Sevier Co.; Summit Co.

Discussion. — This rare species occurs in both creeks and rivers. The adults emerge from March to May.

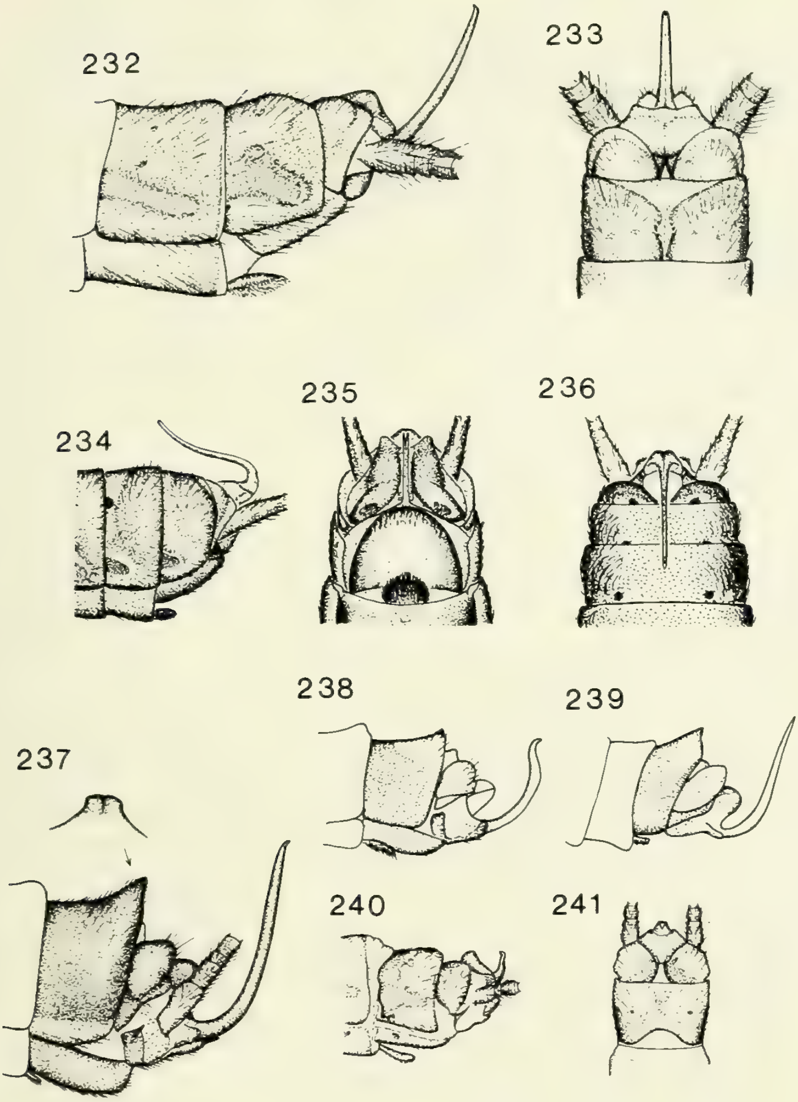
Isocapnia grandis (Banks) (figs. 234-236, 243)

Arsapnia grandis Banks, 1908, 37: 329, male.
Capnia fumigata Claassen, 1937a, 69: 79, male and female; figs. 4, 7, p. 78, male and female genitalia.
Isocapnia fumosa Banks, 1938b, 45: 74.
Isocapnia grandis, Hanson, 1943c, 38: 158; figs. 3-5, p. 161, male and female genitalia.

Type locality. — Victoria, British Columbia.

Geographic range. — Coast, Cascade and Rocky Mts.

Distribution in Rocky Mts. — (Canadian, Northern, Central and Southern Rockies): ALBERTA: Banff N. P. COLORADO: Gunnison



FIGURES 232-241. —*Isocapnia crinita* (Needham and Claassen): 232, male terminalia, lateral view; 233, male terminalia, dorsal view. *Isocapnia grandis* (Banks): 234, male terminalia, lateral view; 235, male terminalia, ventral view; 236, male terminalia, dorsal view. 237, *Isocapnia missourii* Ricker, male terminalia, lateral view; 238, *Isocapnia hyalita* Ricker, male terminalia, lateral view; 239, *Isocapnia integra* Hanson, male terminalia, lateral view. *Isocapnia vedderensis* (Ricker): 240, male terminalia, lateral view; 241, male terminalia, dorsal view.

Co. MONTANA: Flathead Co.; Gallatin Co.; Glacier Co.; Lake Co.; Lewis and Clark Co.; Missoula Co.; Ravalli Co. UTAH: Utah Co.

Discussion. — This species is common in rivers throughout the Pacific Northwest but is rare in more southern latitudes. The adults emerge from March to June.

Isocapnia hyalita Ricker (figs. 238, 246)

Isocapnia hyalita Ricker, 1959, 37: 648, male and female; figs. 14, 16, p. 647, male and female genitalia.

Type locality. — Hyalite Creek, Gallatin Co., Montana.

Geographic range. — Rocky Mts.

Distribution in Rocky Mts. — (Northern, Central and Southern Rockies): COLORADO: Lake Co. IDAHO: Bonneville Co. MONTANA: Gallatin Co.; Missoula Co. UTAH: Tooele Co.; Utah Co.

Discussion. — This rare species occurs in creeks. The adults have been collected only in April and May.

Isocapnia integra Hanson (figs. 239, 245)

Isocapnia integra Hanson, 1943c, 38: 160, female; fig. 6, p. 161, female genitalia.
Isocapnia integra, Ricker, 1959, 37: 649, male; figs. 9, 12, p. 646, male and female genitalia.

Type locality. — Banff N. P., Alberta.

Geographic range. — Alberta and Montana.

Distribution in Rocky Mts. — (Canadian and Northern Rockies): ALBERTA: Banff N. P. MONTANA: Flathead Co.

Discussion. — This rare species has only been collected in Banff N. P., and the Flathead River. The adults emerge from May through June.

Isocapnia missourii Ricker (figs. 237, 247)

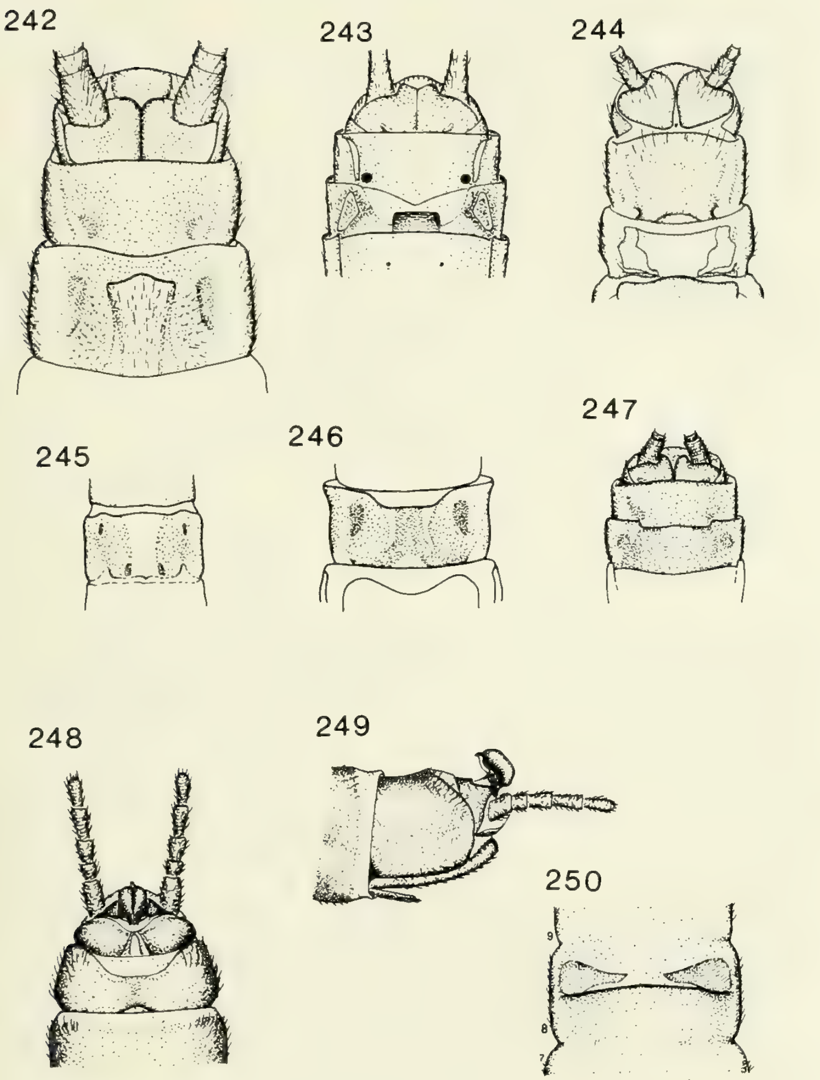
Isocapnia missourii Ricker, 1959, 37: 651, male and female; figs. 13, 15, p. 647, male and female genitalia.

Type locality. — Missouri River at Toston, Broadwater Co., Montana.

Geographic range. — Rocky Mts.

Distribution in Rocky Mts. — (Canadian, Northern and Central Rockies): ALBERTA: Banff N. P. IDAHO: Bonneville Co.; Latah Co. MONTANA: Broadwater Co.; Flathead Co.; Gallatin Co.; Lake Co.; Lincoln Co.; Missoula Co.; Park Co.; Rosebud Co.; Stillwater Co. UTAH: Box Elder Co.; Salt Lake Co.

Discussion. — This species occurs in creeks and rivers. The adults emerge from March to May.



FIGURES 242-250. — 242, *Isocapnia crinita* (Needham and Claassen), female terminalia, ventral view; 243, *Isocapnia grandis* (Banks), female terminalia, ventral view; 244, *Isocapnia vedderensis* (Ricker), female terminalia, ventral view; 245, *Isocapnia integra* Hanson, female terminalia, ventral view; 246, *Isocapnia hyalita* Ricker, female terminalia, ventral view; 247, *Isocapnia missourii* Ricker, female terminalia, ventral view. *Eucapnopsis brevicauda* (Claassen): 248, male terminalia, dorsal view; 249, male terminalia, lateral view; 250, female terminalia, ventral view.

Isocapnia vedderensis (Ricker) (fig. 240, 241, 244)

Eucapnopsis vedderensis Ricker, 1943, 12: 86, male and female; figs. 52-55, p. 88, male and female genitalia.

Isocapnia vedderensis (Ricker), 1965, 22: 488.

Type locality. — Chilliwack River at Vedder Crossing, British Columbia.

Geographic range. — Cascade and Rocky Mts.

Distribution in Rocky Mts. — (Canadian, Northern and Central Rockies): ALBERTA: Banff N. P. MONTANA: Flathead Co.; Gallatin Co.; Lincoln Co.; Stillwater Co. UTAH: Cache Co.; Emery Co.; Summit Co.; Utah Co.

Discussion. — This species is common in creeks and rivers in the Pacific Northwest but is uncommon in the Rocky Mountains. The adults emerge in April and May.

Genus MESOCAPNIA Rauser 1968

The genus *Mesocapnia* has a holarctic distribution pattern and is quite common in far northern localities.

It is characterized in the male by a single epiproctal process that bears a sharp terminal spine (figs. 274, 275). The females are difficult to separate from species in the genus *Capnia.*

Key to the Species of Mesocapnia

Males

1. Wings brachypterous; epiproct very broad dorsally (figs. 274-275) .... *arizonensis*
   Wings macropterous; epiproct narrow dorsally 2
2. Spine at tip of epiproct in line with dorsal surface in lateral view, bulbous swelling present near middle (figs. 280, 281) .... *oenone*
   Spine at tip of epiproct in line with ventral surface in lateral view, bulbous swelling not present 3
3. Epiproct narrow in lateral aspect, with fairly constant width throughout, bent downward slightly at apex (figs. 282, 283) .... *werneri*
   Epiproct moderately wide in lateral aspect, with greatest width medially or near apex, not bent downward at apex 4
4. Epiproct with greatest lateral width medially, becoming wider dorsally towards apex (figs. 278, 279) .... *lapwae*
   Epiproct with greatest lateral width near apex, dosal width remaining fairly constant (figs. 276, 277) .... *frisoni*

Females

1. Subgenital plate broadly rounded; sclerotized patches on lateral margins of seventh sternum faint or absent; emerging during late summer or fall (fig. 287) ..... *oenone*
   Subgenital plate less broadly rounded, often somewhat pointed medially; sclerotized patches on lateral margins of seventh sternum distinct; emerging during winter and spring 2
2. Median posterior margin of subgenital plate somewhat pointed 3
   Median posterior margin of subgenital plate not pointed 4
3. Paired sclerotized patches not apparent on abdominal sterna (fig. 285) ..... *frisoni*
   Paired sclerotized patches apparent on abdominal sterna (fig. 284) ..... *arizonensis*
4. Posterior pointed area of subgenital plate extending beyond posterior margin of eighth sternum (fig. 286) ..... *lapwae*
   Posterior pointed area of subgenital plate recessed and not extending beyond posterior margin of eighth sternum (fig. 288) ..... *werneri*

Mesocapnia arizonensis (Baumann and Gaufin)
(figs. 274, 275, 284, 296, 297)

Capnia arizonensis Baumann and Gaufin, 1969, 80: 75, male, female and nymph; figs. 1-3, p. 76, male and female genitalia.
Mesocapnia arizonensis, Zwick, 1973, 94: 385.

Type locality. — Big Bug Creek near Mayer, Yavapai Co., Arizona.

Geographic range. — Arizona.

Distribution in Rocky Mts. — (Southern Rockies): ARIZONA: Gila Co.; Pima Co.; Yavapai Co.

Discussion. — This species occurs in intermittent streams and in rivers which become fairly warm during the summer and fall. Adults emerge from February to April.

Mesocapnia frisoni (Baumann and Gaufin) (figs. 276, 277, 285)

Capnia projecta, Gaufin, Nebeker and Sessions, 1966, 14: 45.
Capnia frisoni Baumann and Gaufin, 1970, 96: 441, male, female and nymph; figs. 15-17, p. 464, male and female genitalia.
Mesocapnia frisoni, Zwick, 1973, 94: 386.

Type locality. — Ash Creek, Anderson Junction, Washington Co., Utah.

Geographic range. — Rocky Mts.

Distribution in Rocky Mts. — (Southern Rockies): COLORADO: Larimer Co. NEW MEXICO: Guadalupe Co.; Lincoln Co. TEXAS: Randall Co. UTAH: Washington Co.

Discussion. — This species is found in creeks and rivers at low elevations near mountainous areas. The adults emerge from January to May.

Mesocapnia lapwae (Baumann and Gaufin) (figs. 278, 279, 286, 298, 299)

Capnia lapwae Baumann and Gaufin, 1970, 96: 443, male and female; figs. 9-11, p. 463, male and female genitalia.
Mesocapnia lapwae, Zwick, 1973, 94: 386.

Type locality. — Lapwai Creek, near Winchester, Nez Perce Co., Idaho.

Geographic range. — Coast, Cascade and Rocky Mts.

Distribution in Rocky Mts. — (Northern Rockies): IDAHO: Latah Co., Nez Perce Co.

Discussion. — This uncommon species occurs in both creeks and rivers. The adults emerge in February and March.

Mesocapnia oenone (Neave) (figs. 280, 281, 287)

Capnia oenone Neave, 1929, 4: 162, male and female; figs. 9-10, pl. 1, male and female genitalia.
Mesocapnia oenone, Zwick, 1973, 94: 387.

Type locality. — Jacques Lake, Jasper N. P., Alberta.

Geographic range. — Coast, Cascade and Rocky Mts.

Distribution in Rocky Mts. — (Canadian and Northern Rockies): ALBERTA: Banff N. P.; Jasper N. P. BRITISH COLUMBIA: Summit Lake. MONTANA: Flathead Co.; Gallatin Co.; Glacier Co.; Missoula Co.; Powell Co.

Discussion. — This species occurs in the northern portion of the Rocky Mountains and is replaced in Alaska by *Mesocapnia ogotoruka.* The adults emerge from August to December with the heaviest emergence occurring in September and October.

Mesocapnia werneri (Baumann and Gaufin) (figs. 282, 283, 288)

Capnia werneri Baumann and Gaufin, 1970, 96: 452, male and female; figs. 12-14, p. 464, male and female genitalia.
Mesocapnia werneri, Zwick, 1973, 94: 388.

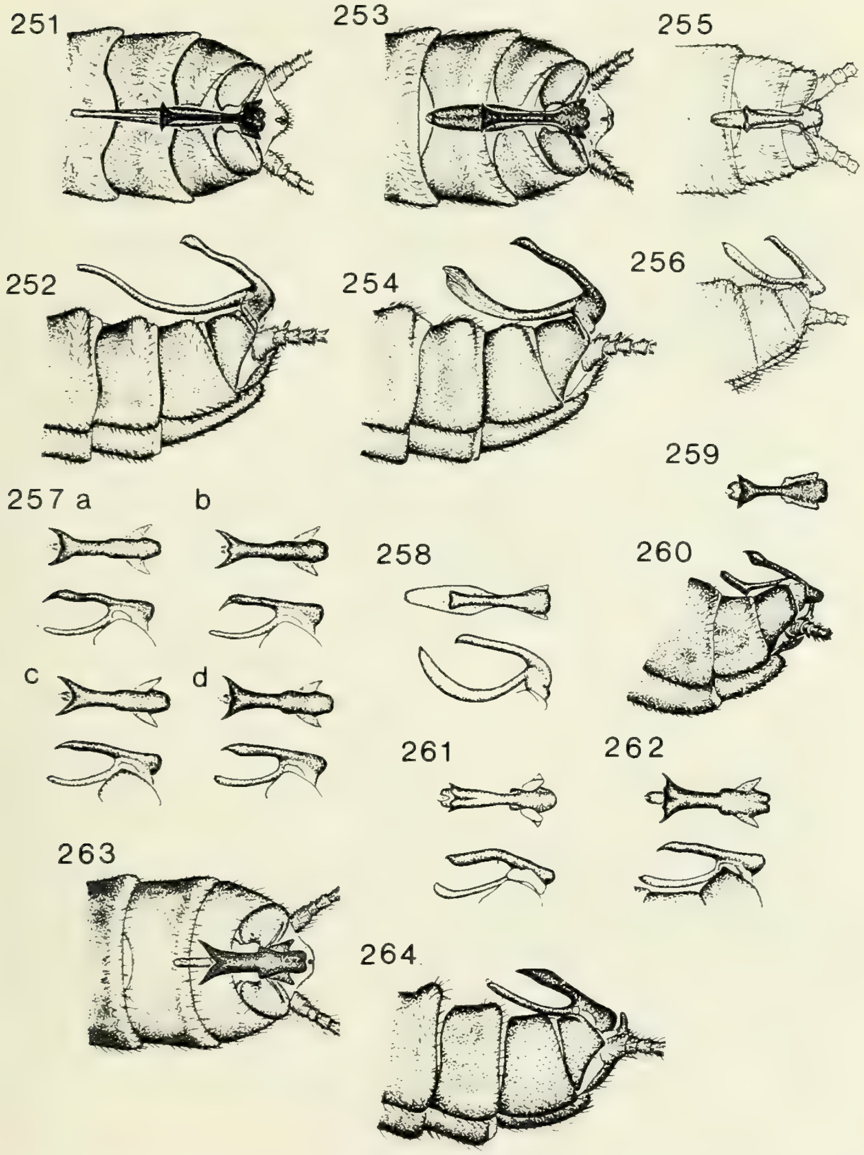
Type locality. — Bear Canyon, Pima Co., Arizona.

Geographic range. — Arizona and California.

Distribution in Rocky Mts. — (Southern Rockies): ARIZONA: Coconino Co.; Gila Co.; Pima Co.

Discussion. — This species is both rare and restricted in its distribution. The adults emerge from October to early April.

FIGURES 251-264. — *Utacapnia distincta* (Frison): 251, male terminalia, dorsal view; 252, male terminalia, lateral view. *Utacapnia trava* (Nebeker and Gaufin): 253, male terminalia, dorsal view; 254, male terminalia, lateral view. *Utacapnia tahoensis* (Nebeker and Gaufin): 255, male terminalia, dorsal view; 256, male ter-



minalia, lateral view. *Utacapnia logana* (Nebeker and Gaufin): 257a-d, epiproct, dorsal and lateral views. 258, *Utacapnia sierra* (Nebeker and Gaufin), epiproct, dorsal and lateral views. *Utacapnia poda* (Nebeker and Gaufin): 259, epiproct, dorsal view; 260, male terminalia, lateral view. 261, *Utacapnia columbiana* (Claassen), epiproct, dorsal and lateral views; 262, *Utacapnia imbera* (Nebeker and Gaufin), epiproct, dorsal and lateral views. *Utacapnia lemoniana* (Nebeker and Gaufin): 263, male terminalia, dorsal view; 264, male terminalia, lateral view.

Genus PARACAPNIA Hanson 1946

This genus has an amphinearctic distribution pattern but is most common in eastern North America.

The males have a thin narrow epiproct which has an internal featherlike element that is sometimes extruded naturally (fig. 289).

The females have a distinctive subgenital plate (fig. 290) and the abdomen is covered by long black hairs.

Paracapnia angulata Hanson (figs. 289, 290, 292)

Capnia opis, Frison, 1942b, 22: 264; fig. 32, p. 264, male and female genitalia.
Paracapnia angulata Hanson, 1961, 56: 29, male and female; figs. 1-4, p. 28, male epiproct.

Type locality. — Pelham, Massachusetts.

Geographic range. — Massachusetts to Colorado and Wyoming.

Distribution in Rocky Mts. — (Central Rockies): COLORADO: Routt Co.: Walton Creek; Willow Creek. WYOMING: Albany Co., Little Laramie River.

Discussion. — This species is most common in eastern North America. The adults from Rocky Mountain localities were collected in April.

Genus UTACAPNIA Gaufin 1970

Utacapnia is primarily a western North American genus with one species occurring in Labrador. The wing length exhibited varies from apterous to macropterous (figs. 302, 303). Usually only the males show reduction in wing length but the females of a few species show similar modifications.

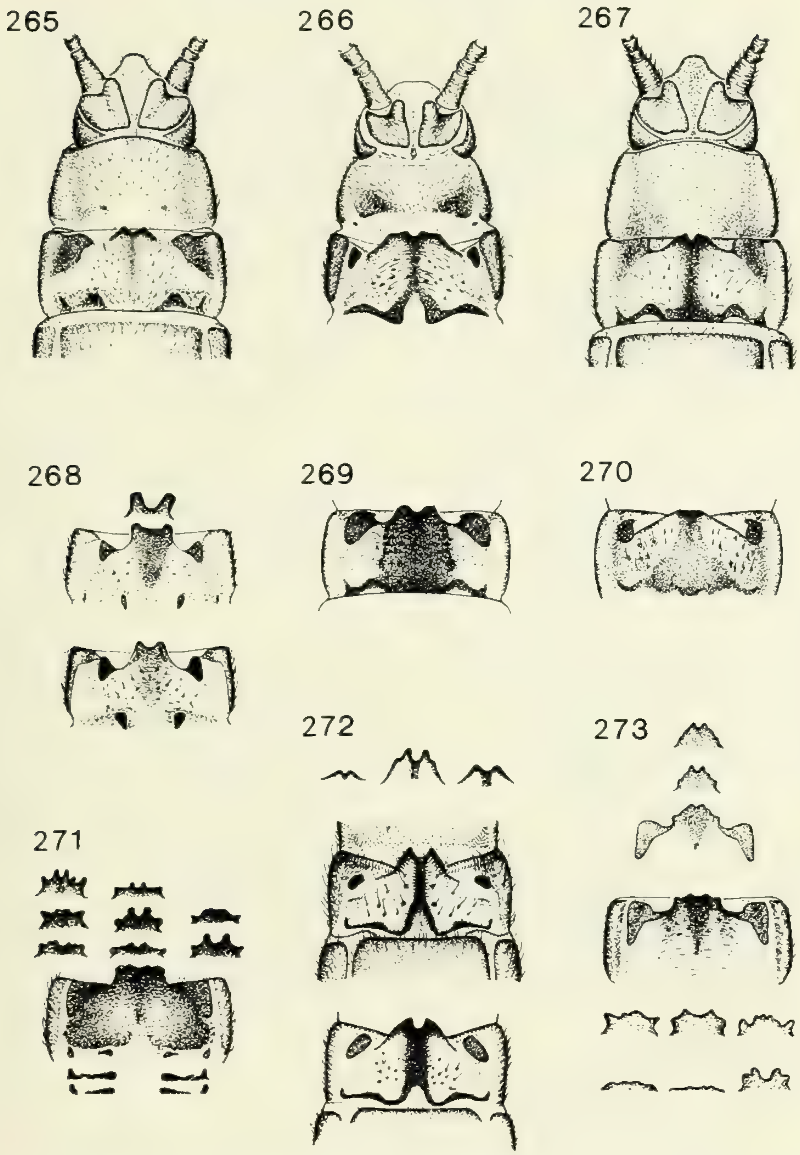
The males are characterized by an epiproct that is composed of two parallel processes which are lined up one under the other (figs. 251, 252). The females all have a large subgenital plate that extends over the anterior margin of sternum nine (fig. 265). The bulk of the plate is usually light in color with a distinctive median sclerotized pattern. The nymphs are large and elongate as in figure 162.

Key to the Species of Utacapnia

Males

1. Wings short, not reaching to apex of abdomen 2
   Wings long, extending beyond apex of abdomen 5
2. Wings micropterous (less than 2 mm) not extending beyond third abdominal segment 3

Figures 265-273. — 265, *Utacapnia distincta* (Frison), female terminalia, ventral view; 266, *Utacapnia poda* (Nebeker and Gaufin), female terminalia, ventral view;



267, *Utacapnia trava* (Nebeker and Gaufin), female terminalia, ventral view; 268, *Utacapnia imbera* (Nebeker and Gaufin), female terminalia, ventral views; 269, *Utacapnia sierra* (Nebeker and Gaufin), female terminalia, ventral view; 270, *Utacapnia tahoensis* (Nebeker and Gaufin), female terminalia; ventral view; 271, *Utacapnia logana* (Nebeker and Gaufin), female terminalia, ventral views; 272, *Utacapnia lemoniana* (Nebeker and Gaufin), female terminalia, ventral views; 273, *Utacapnia columbiana* (Claassen), female terminalia, ventral views.

Wings brachypterous (ca. 3 mm), not extending beyond seventh tergum .... *logana* (in part)

3. Upper process of epiproct slender, with fan-shaped enlargement at tip; lower process nearly twice as long as upper process 4

   Upper process of epiproct massive and deeply forked, forming two definite prongs; lower process one third longer than upper process (figs. 263, 264) .... *lemoniana*

4. Lower process of epiproct slender and tapering to a point (figs. 251, 252) .... *distincta*

   Lower process of epiproct massive, wider than widest point on upper process (figs. 253, 254) .... *trava*

5. Lower process of epiproct with distinctive foot-like enlargement at apex (figs. 259, 260) .... *poda*

   Lower process of epiproct without foot-like enlargement 6

6. Apex of lower process of epiproct three fourths width of prongs of upper process (fig. 261) .... *columbiana*

   Apex of lower process one fourth width of prongs of upper process (fig. 257) .... *logana* (in part)

Females

1. Dark pigmentation of eighth abdominal sternum extensive, covering eighty percent of ventral surface (fig. 271) .... *logana*

   Dark pigmentation of eighth abdominal sternum restricted to posterior lobe and median line 2

2. No anterior sclerotization on eighth abdominal sternum (fig. 273) .... *columbiana*

   Anterior sclerotization present, varying from two small median patches to a large conspicuous pattern 3

3. Small bilobed subgenital plate isolated from large lateral sclerotized patches (fig. 265) .... *distincta*

   Subgenital plate connected to lateral sclerotized patches by sclerotized line 4

4. Lateral sclerotized patches large and triangular (fig. 267) .... *trava*

   Lateral sclerotized patches small and oval 5

5. Median produced area of subgenital plate one fourth width of entire eighth sternum (fig. 272) .... *lemoniana*

   Median produced area of subgenital plate one half width of entire eighth sternum (fig. 266) .... *poda*

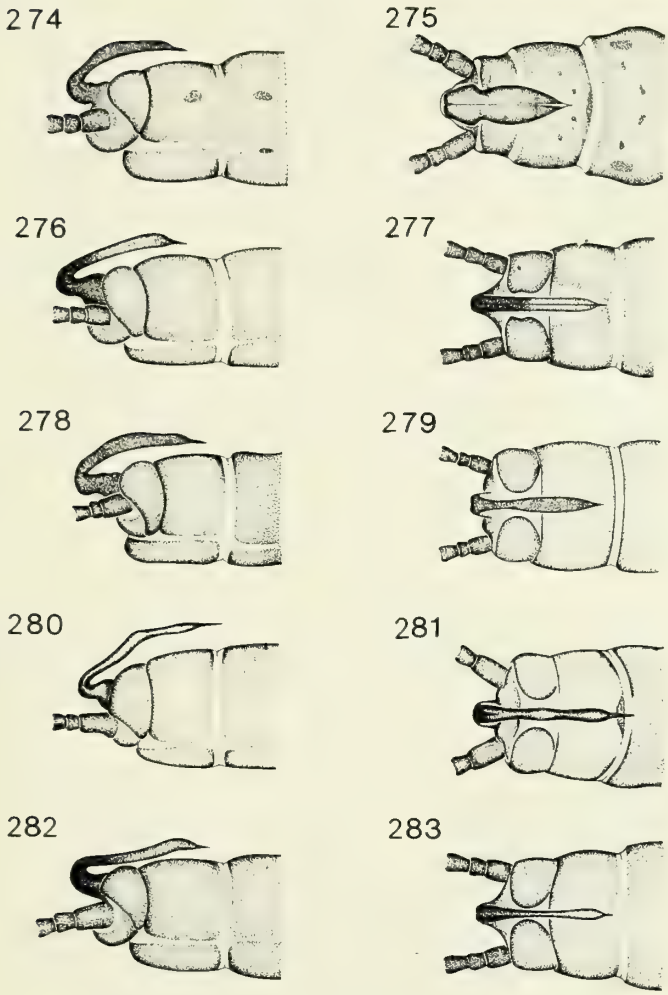
Utacapnia columbiana (Claassen) (figs. 261, 273)

Capnia columbiana Claassen, 1924, 56: 47.
Capnia columbiana, Nebeker and Gaufin, 1965, 91: 469, male, female and nymph; pl. 29, figs. 8 9, female genitalia; pl. 30, fig. 19, male genitalia.
Capnia (*Utacapnia*) *columbiana,* Gaufin, 1970, 81: 197.
Utacapnia columbiana, Zwick, 1973, 94: 390.

Type locality. — Terrace, British Columbia.

Geographic range. — Montana to Alaska.

Distribution in Rocky Mts. — (Canadian and Northern Rockies): ALBERTA: Banff N. P. MONTANA: Lincoln Co.



FIGURES 274-283. — *Mesocapnia arizonensis* (Baumann and Gaufin): 274, male terminalia, lateral view; 275, male terminalia, dorsal view. *Mesocapnia frisoni* (Baumann and Gaufin): 276, male terminalia, lateral view; 277, male terminalia, dorsal view. *Mesocapnia lapwae* (Baumann and Gaufin): 278, male terminalia, lateral view; 279, male terminalia, dorsal view. *Mesocapnia oenone* (Neave): 280, male terminalia, lateral view; 281, male terminalia, dorsal view. *Mesocapnia werneri* (Baumann and Gaufin): 282, male terminalia, lateral view; 283, male terminalia, dorsal view.

Discussion. — This species is found in creeks and rivers from sea level to near 5,000 ft. It appears to be restricted to areas of high precipitation. The adults emerge from February to June.

Utacapnia distincta (Frison) (figs. 251, 252, 265, 300, 301)

Capnia distincta Frison, 1937, 21: 86, male and female; fig. 74, p. 86, male and female genitalia.
Utacapnia distincta, Zwick, 1973, 94: 390.

Type locality. — Hayden Valley, Yellowstone N. P., Wyoming.

Geographic range. — Rocky Mts.

Distribution in Rocky Mts. — (Canadian, Northern and Central Rockies): ALBERTA: Banff N. P. IDAHO: Blaine Co.; Bonneville Co.; Custer Co.; Fremont Co.; Teton Co.; Valley Co. MONTANA: Flathead Co.; Gallatin Co.; Granite Co.; Lake Co.; Missoula Co.; Ravalli Co. WYOMING: Park Co.; Teton Co.

Discussion. — This species is common in creeks and rivers throughout its range. It is found at elevations ranging from 3500 ft. to 7000 ft. The adults emerge from March to early June.

Utacapnia lemoniana (Nebeker and Gaufin) (figs. 162, 263, 264, 272)

Capnia lemoniana Nebeker and Gaufin, 1965, 91: 447, male, female and nymph; pl. 28, fig. 1, nymph; pl. 29, figs. 11-12, female genitalia; figs. 28-29, male genitalia.
Capnia (*Utacapnia*) *lemoniana*, Gaufin, 1970, 81: 197.
Utacapnia lemoniana, Zwick, 1973, 94: 391.

Type locality. — Provo River, Wasatch Co., Utah.

Geographic range. — Rocky Mts.

Distribution in Rocky Mts. — (Central Rockies): COLORADO: Routt Co. IDAHO: Bannock Co.; Bear Lake Co.; Blaine Co.; Franklin Co.; Fremont Co.; Lake Co.; Lemhi Co.; Nez Perce Co.; Oneida Co.; Teton Co.; Valley Co. UTAH: Carbon Co.; Daggett Co.; Duchesne Co.; Salt Lake Co.; Sevier Co.; Summit Co.; Wasatch Co.; Weber Co.; Utah Co. WYOMING: Lincoln Co.; Sublette Co.; Uinta Co.

Discussion. — This species occurs commonly in creeks and rivers at altitudes from 1500 ft. to 8000 ft. The adults emerge from February to June.

Utacapnia logana (Nebeker and Gaufin) (figs. 257, 271)

Capnia logana Nebeker and Gaufin, 1965, 91: 472, male and female; pl. 29, fig. 10, female genitalia; pl. 30, figs. 20-23, male genitalia.
Utacapnia logana, Zwick, 1973, 94: 391.

Type locality. — Logan River, Cache Co., Utah.

Geographic range. — Rocky Mts.

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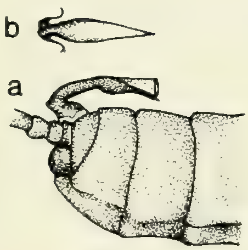

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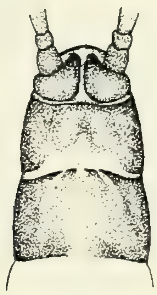


FIGURES 284-290. — 284, *Mesocapnia arizonensis* (Baumann and Gaufin), female terminalia, ventral view; 285, *Mesocapnia frisoni* (Baumann and Gaufin), female terminalia, ventral view; 286, *Mesocapnia lapwae* (Baumann and Gaufin), female terminalia, ventral view; 287, *Mesocapnia oenone* (Neave), female terminalia, ventral view; 288, *Mesocapnia werneri* (Baumann and Gaufin), female terminalia, ventral view. *Paracapnia angulata* Hanson: 289a, male terminalia, lateral view; 289b, epiproct, dorsal view; 290, female terminalia, ventral view.

Distribution in Rocky Mts. — (Central and Southern Rockies): COLORADO: Boulder Co.; El Paso Co.; Gilpin Co.; Gunnison Co.; Larimer Co.; Montrose Co.; Routt Co.; San Juan Co. UTAH: Beaver Co.; Cache Co.; Iron Co.; Millard Co.; Salt Lake Co.; Sevier Co.; Summit Co.; Utah Co.; Wasatch Co.; Weber Co. WYOMING: Albany Co.; Platte Co.; Sublette Co.; Teton Co.

Discussion. — This species is found commonly in creeks and rivers throughout its range. It is found at rather high elevations and shows variation in wing length at different elevations and latitudes. The adults emerge from February to May.

Utacapnia poda (Nebeker and Gaufin) (figs. 19, 259, 260, 266)

Capnia poda Nebeker and Gaufin, 1965, 91: 475, male, female and nymph; pl. 29, fig. 5, female genitalia; pl. 30, fig. 26, male genitalia.
Utacapnia poda, Zwick, 1973, 94: 391.

Type locality. — Gunnison River, Gunnison Co., Colorado.

Geographic range. — Rocky Mts.

Distribution in Rocky Mts. — (Northern, Central and Southern Rockies): COLORADO: Archuleta Co.; Grand Co.; Gunnison Co.; Hinsdale Co.; La Plata Co.; Moffat Co.; Mineral Co.; Montrose Co.; Ouray Co.; Routt Co.; Saguache Co. MONTANA: Flathead Co.; Lake Co.; Missoula Co.; Park Co.; Sweet Grass Co. UTAH: Uintah Co. WYOMING: Platte Co.

Discussion. — This species is found commonly in rivers and some creeks at elevations ranging from 4000 ft. to 8500 ft. The adults emerge from February through mid-April.

Utacapnia trava (Nebeker and Gaufin) (figs. 253, 254, 267)

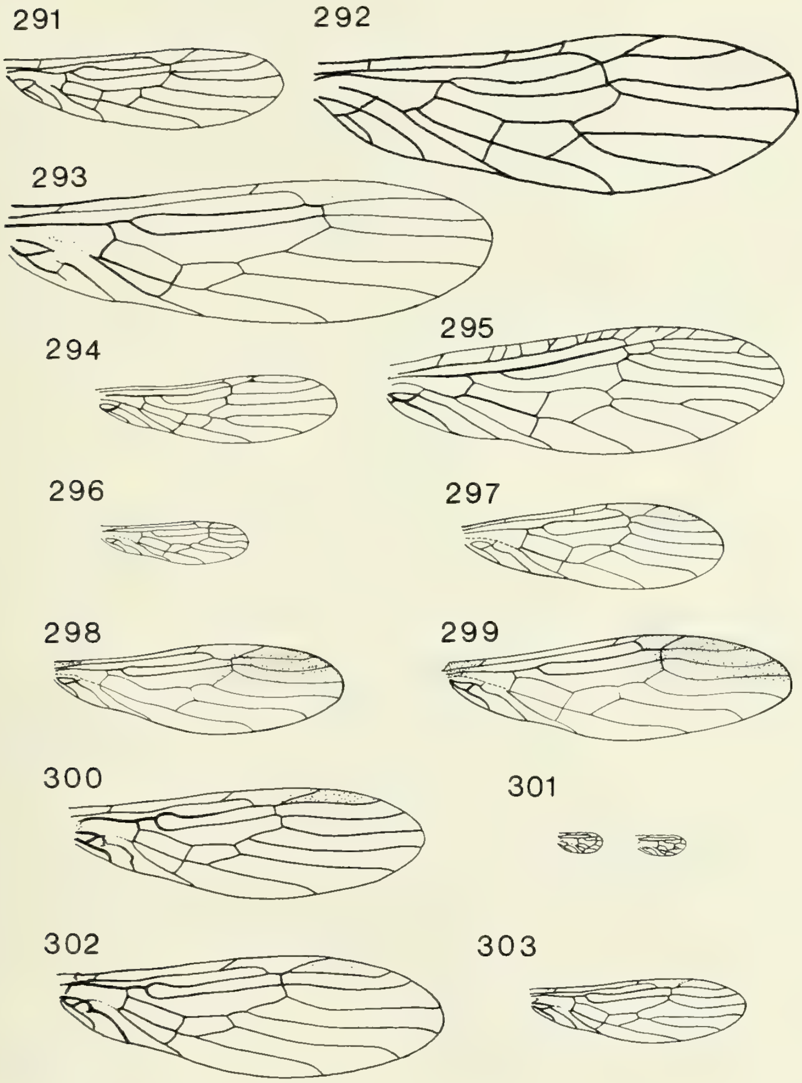
Capnia trava Nebeker and Gaufin, 1965, 91: 479, male and female; pl. 29, fig. 3, female genitalia; pl. 30, figs. 24-25, male genitalia.
Utacapnia trava, Zwick, 1973, 94: 392.

Type locality. — Shields River, Park Co., Montana.

Geographic range. — Rocky Mts.

Distribution in Rocky Mts. — (Canadian and Northern Rockies): ALBERTA: Banff N. P. IDAHO: Bonner Co.; Boundary Co. MONTANA: Flathead Co.; Gallatin Co.; Glacier Co.; Lake Co.; Meagher Co.; Missoula Co.; Park Co.; Ravalli Co.

Discussion. — This species occurs commonly in creeks and rivers at elevations ranging from 3500 ft. to 5500 ft. The adults emerge from February to early June.



FIGURES 291-303. — Forewings: 291, *Capnia* sp.; 292, *Paracapnia* sp.; 293, *Isocapnia* sp.; 294, *Eucapnopsis* sp.; 295, *Bolshecapnia* sp. *Mesocapnia arizonensis* (Baumann and Gaufin): 296, male; 297, female. *Mesocapnia lapwae* (Baumann and Gaufin): 298, male; 299, female. *Utacapnia distincta* (Frison): 300, female; 301, male. *Utacapnia imbera* (Nebeker and Gaufin): 302, female; 303, male.

Family **Leuctridae**

This family is represented in the Rocky Mountains by five genera in two subfamilies. The adults are usually small and dark grey or black in color. The wings are uniformly dark in color and they tend to curl laterally producing a slightly rolled appearance. The adult cerci are composed of a single segment in both males and females (figs. 306, 328).

The nymphs are lightly colored and the wing pads are parallel with the body axis. They are similar to the nymphs of the Capniidae but are usually much more elongate.

The adults emerge in the spring or summer and a few species as late as early fall. They are often found in springs and the genus *Perlomyia* seems to be limited to springs and spring-fed habitats.

Key to the Subfamilies and Genera of Leuctridae

Males

1. Ninth tergum with distinctive projections (figs. 340, 341), large (15 mm or more) and robust .... MEGALEUCTRINAE .... *Megaleuctra*
   Ninth sternum without projections; small (15 mm or less) and narrow .... LEUCTRINAE 2
2. Vesicle absent from ninth sternum (fig. 337) .... *Despaxia*
   Vesicle present on ninth sternum 3
3. Epiproct present (fig. 332, 333), ninth sternum with elongate apex (fig. 333) . ... *Perlomyia*
   Epiproct absent (figs. 323, 324), ninth sternum with rounded apex (fig. 326) .. .. *Paraleuctra*

Females

1. Subgenital plate long and narrow (fig. 342) .... MEGALEUCTRINAE .... *Megaleuctra*
   Subgenital plate short and blunt, sometimes with small sclerotized appendages .... LEUCTRINAE 2
2. Abdomen sclerotized only in small patches on each segment (fig. 339) .... *Despaxia*
   Abdomen almost completely sclerotized 3
3. Eighth sternum entire, forming bilobed subgenital plate (fig. 331) .... *Paraleuctra*
   Eighth sternum bisected medially, not forming complete subgenital plate (fig. 334) .... *Perlomyia*

Nymphs

1. General shape short and robust (rather nemourid-like) .... MEGALEUCTRINAE .... *Megaleuctra*
   General shape long and thin (rather capniid-like) .... LEUCTRINAE 2
2. Abdomen and thorax nearly naked .... *Despaxia*
   Abdomen and thorax with moderate to numerous hairs .... *Paraleuctra* and *Perlomyia*

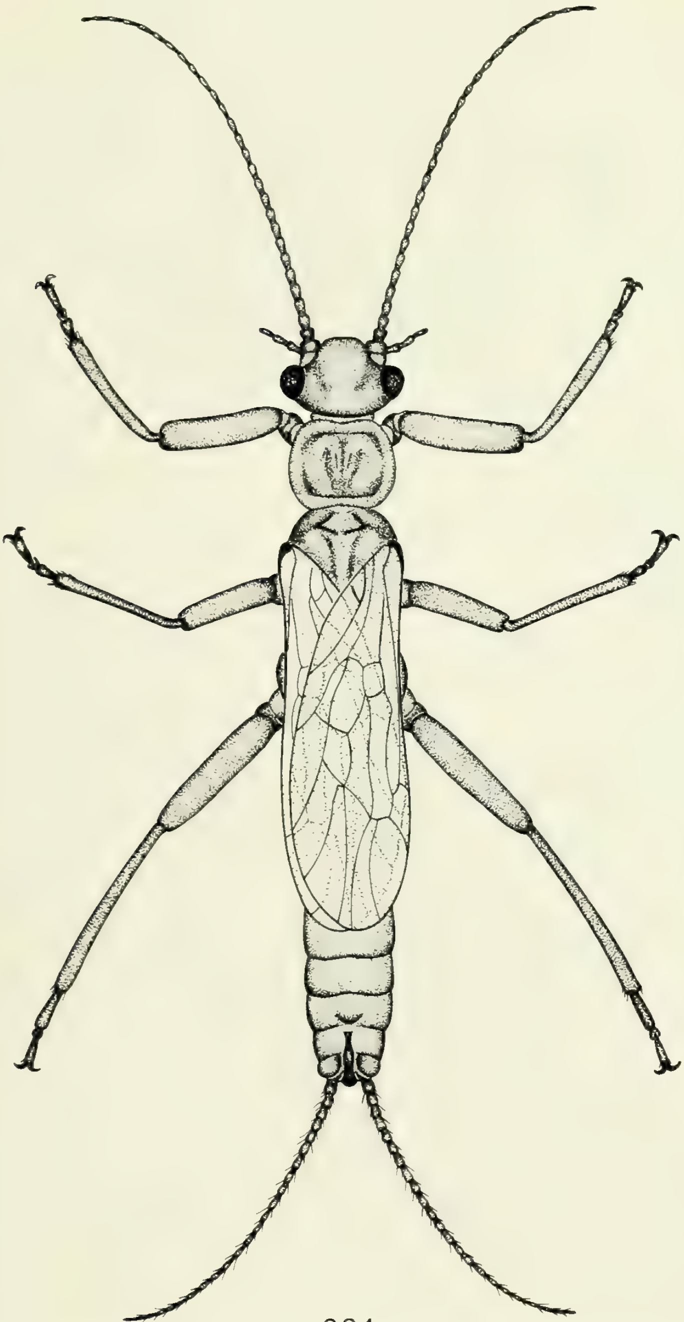


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FIGURE 304. — *Capnia nana wasatchae* (Nebeker and Gaufin), adult male, habitus.

Subfamily Leuctrinae

Genus DESPAXIA Ricker 1943

This monotypic genus is endemic to the northwestern part of North America. The adults emerge in late summer or fall and they are seldom collected for this reason.

The males have relatively simple and only slightly sclerotized cerci when compared to the other leuctrid genera. The titillator is the most obvious part of the male terminalia but it is relatively small and delicate (figs. 337, 338). The female subgenital plate contains a narrow sclerotized stripe that is not notched or developed into a definite plate (fig. 339).

Despaxia augusta (Banks) (figs. 337-339)

Leuctra augusta Banks, 1907b, 39: 330.
Leuctra glabra Claassen, 1923, 55: 261.
Leuctra augusta, Needham and Claassen, 1925, 2: 224, female; fig. 1, p. 375, female genitalia.
Leuctra glabra, Needham and Claassen, 1925, 2: 228, male; figs. 9-11, p. 373, male genitalia.
Leuctra (*Despaxia*) *glabra,* Ricker, 1943, 12: 78, nymph; fig. 46, p. 79, nymph.
Despaxia augusta, Illies, 1966, 82: 171.

Type locality. — Port Renfrew, British Columbia.

Geographic range. — Coast, Cascade, Rocky and Sierra Nevada Mts.

Distribution in Rocky Mts. — (Canadian and Northern Rockies): BRITISH COLUMBIA: Mt. Revelstoke N. P. IDAHO: Benewah Co.; Bonner Co. MONTANA: Flathead Co.; Gallatin Co.; Lake Co.; Missoula Co.

Discussion. — This uncommon species is found in creeks and small streams. The adults emerge from July through December.

Genus PARALEUCTRA Hanson 1941

Paraleuctra exhibits a holarctic distribution pattern and can be common in Rocky Mountain streams.

The males have heavily sclerotized cerci that terminate in a fork-like apex (figs. 306, 307). Females are difficult to separate because of their simple bilobed subgenital plate (fig. 311). Two species groups are apparent: the *P. sara* group, characterized by a simple elongate titillator and the *P. occidentalis* group, that has a titillator with an enlarged variable apex.

The adults emerge in the spring and summer months and are most common in waters influenced by springs.

Key to the Species of Paraleuctra

Males

1. Titillator with enlarged area at or near apex 2
   Titillator without distinct enlarged area 4
2. Enlarged area of titillator subapical when viewed dorsally (figs. 312, 315b) .... *jewetti*
   Enlarged area of titillator apical when viewed from above (figs. 308, 309) 3
3. Apical enlargement of titillator large; subapical area wide (figs. 320, 321) .... *rickeri*
   Apical enlargement of titillator moderate; subapical area constricted (figs. 308, 309) .... *occidentalis*
4. Upper prong of cerci with three lobes (figs. 326, 327) .... *purcellana*
   Upper prong of cerci with single large lobe and small subapical projection 5
5. Upper prong of cerci larger than lower prong; lower prong simple (figs. 329, 330) .... *vershina*
   Upper and lower prongs approximately equal in size, both prongs with small subapical projections (figs. 323, 324) .... *forcipata*

Females

1. Subgenital plate well developed, distinctly bilobed, extending completely over ninth sternum 2
   Subgenital plate poorly developed, weakly bilobed, extending slightly onto ninth sternum (fig. 311) .... *occidentalis* group
2. Lobes of subgenital plate long and narrow throughout length (fig. 328) .... *purcellana*
   Lobes of subgenital plate broadly rounded, with broad base (figs. 325, 331) .... *forcipata* and *vershina*

Paraleuctra forcipata (Frison) (figs. 323-325)

Leuctra forcipata Frison, 1937, 23: 85, male and female; fig. 72, p. 85, male and female genitalia.
Leuctra (*Paraleuctra*) *forcipata,* Jewett, 1959, 3: 39.
Paraleuctra forcipata, Illies, 1966, 82: 114.

Type locality. — Corvallis, Oregon.

Geographic range. — Coast, Cascade, Rocky and Sierra Nevada Mts.

Distribution in Rocky Mts. — (Canadian and Northern Rockies): ALBERTA: Banff N. P. BRITISH COLUMBIA: Ainsworth; Glacier N. P. IDAHO: Bannock Co. MONTANA: Flathead Co.; Gallatin Co.; Glacier Co.; Granite Co.; Lake Co.; Lewis and Clark Co.; Missoula Co.; Ravalli Co.

Discussion. — The nymphs occur in rapidly flowing or precipitous creeks. The adults emerge from April to July.

Paraleuctra jewetti Nebeker and Gaufin (figs. 312-316)

Paraleuctra jewetti Nebeker and Gaufin, 1966c, 77: 255, male; fig. 2, p. 256, male genitalia.
Paraleuctra jewetti, Zwick, 1973, 94: 410.

Type locality. — Big Cottonwood Creek, Salt Lake Co., Utah.

Geographic range. — Rocky Mts.

Distribution in Rocky Mts. — (Northern, Central and Southern Rockies): COLORADO: Grand Co. MONTANA: Glacier Co. UTAH: Salt Lake Co.

Discussion. — This species occurs in swiftly flowing, cold creeks. The adults emerge from late May to early July.

Paraleuctra occidentalis (Banks) (figs. 305-311)

Leuctra occidentalis Banks, 1907b, (not Needham and Claassen, 1925), 39: 329.
Leuctra bradleyi Claassen, 1923, 55: 257.
Leuctra bradleyi, Needham and Claassen, 1925, 2: 225, male; figs. 12-15, p. 373, male genitalia.
Leuctra (*Paraleuctra*) *projecta* Frison, 1942b, 22: 260, male; fig. 25, p. 260, cercus.
Leuctra (*Paraleuctra*) *bradleyi,* Ricker, 1943, 12: 76, female and nymph; figs. 44-53, p. 79, nymph and female.
Paraleuctra occidentalis, Illies, 1966, 82: 114.

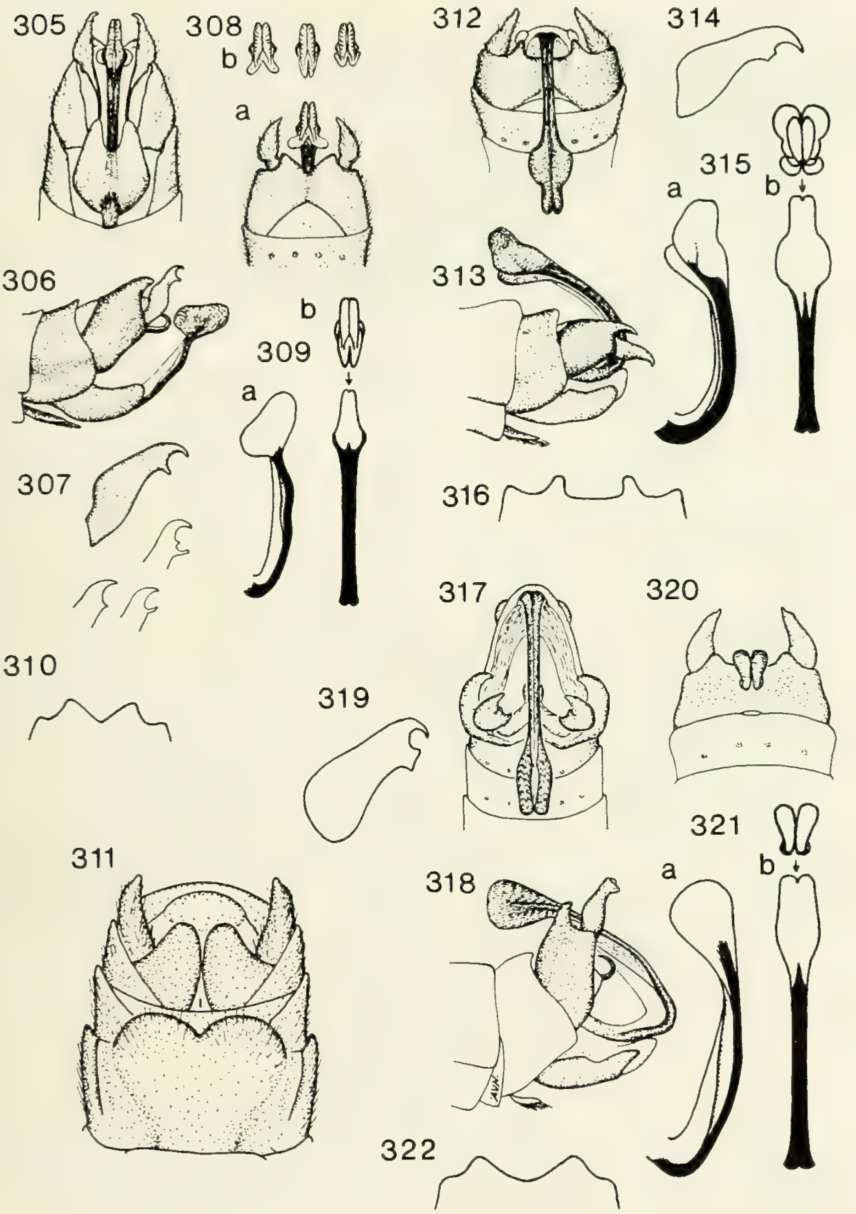
Type locality. — Laggan (Lake Louise), Alberta.

Geographic range. — Coast, Cascade, Rocky and Sierra Nevada Mts.

Distribution in Rocky Mts. — (Canadian, Northern, Central and Southern Rockies): ALBERTA: Banff N. P. BRITISH COLUMBIA: Campbell Creek, Purcell Range; Glacier N. P.; Summit Lake. COLORADO: Larimer Co.; Routt Co. IDAHO: Blaine Co.; Franklin Co.; Idaho Co.; Lemhi Co. MONTANA: Flathead Co.; Gallatin Co.; Glacier Co.; Granite Co.; Lake Co.; Lincoln Co.; Missoula Co.; Sweet Grass Co. NEW MEXICO: Taos Co. OREGON: Baker Co. UTAH: Davis Co.; Salt Lake Co.; Utah Co.; Wasatch Co. WYOMING: Albany Co.; Platte Co.

Discussion. — This common species is found in creeks and rivers. The adults emerge from February to August.

FIGURES 305-322. — *Paraleuctra occidentalis* (Banks): 305, male terminalia, ventral view; 306, male terminalia, lateral view; 307, cerci, showing variations; 308a, male terminalia, dorsal view; 308b, titillator, showing variations; 309a, titillator, lateral view; 309b, titillator, dorsal view; 310, ninth tergum, male; 311, female terminalia, ventral view. *Paraleuctra jewetti* (Nebeker and Gaufin): 312, male terminalia, dorsal view; 313, male terminalia, lateral view; 314, cercus; 315a, titillator, lateral view; 315b, titillator, dorsal view; 316, ninth tergum, male. *Paraleuctra*



rickeri (Nebeker and Gaufin): 317, male terminalia, terminal view; 318, male terminalia, lateral view; 319, cercus; 320, male terminalia, dorsal view; 321a, titillator, lateral view; 321b, titillator, dorsal view; 322, ninth tergum, male.

Paraleuctra purcellana (Neave) (figs. 326-328)

Leuctra purcellana Neave, 1934, 66: 2, male; figs. 4-5, p. 3, male genitalia.
Leuctra bilobata Claassen, 1937b, 10: 45, female; fig. 9, p. 51, female genitalia.
Leuctra (*Paraleuctra*) *purcellana,* Ricker, 1952, 18: 172.
Paraleuctra purcellana, Illies, 1966, 82: 115.

Type locality. — Campbell Creek, Purcell Range, British Columbia.

Geographic range. — Rocky Mts.

Distribution in Rocky Mts. — (Canadian and Northern Rockies): ALBERTA: Banff N. P. BRITISH COLUMBIA: Purcell Range; Selkirk Mts. MONTANA: Flathead Co.; Gallatin Co.; Glacier Co.; Lake Co.; Missoula Co.

Discussion. — This rare species is found in creeks. The adults emerge from May to August.

Paraleuctra rickeri Nebeker and Gaufin (figs. 317-322)

Paraleuctra rickeri Nebeker and Gaufin, 1966c, 77: 258, male; fig. 3, p. 256, male genitalia.
Paraleuctra rickeri, Zwick, 1973, 94: 410.

Type locality. — Big Cottonwood Creek, Salt Lake Co., Utah.

Geographic range. — Rocky Mts. and Alaska.

Distribution in Rocky Mts. — (Northern, Central and Southern Rockies): IDAHO: Latah Co. MONTANA: Glacier Co.; Gallatin Co.; Missoula Co.; Lake Co. NEW MEXICO: Taos Co. UTAH: Box Elder Co.; Salt Lake Co.

Discussion. — This species occurs in swift flowing cold creeks and spring-fed seeps. Adults have been collected from March to July.

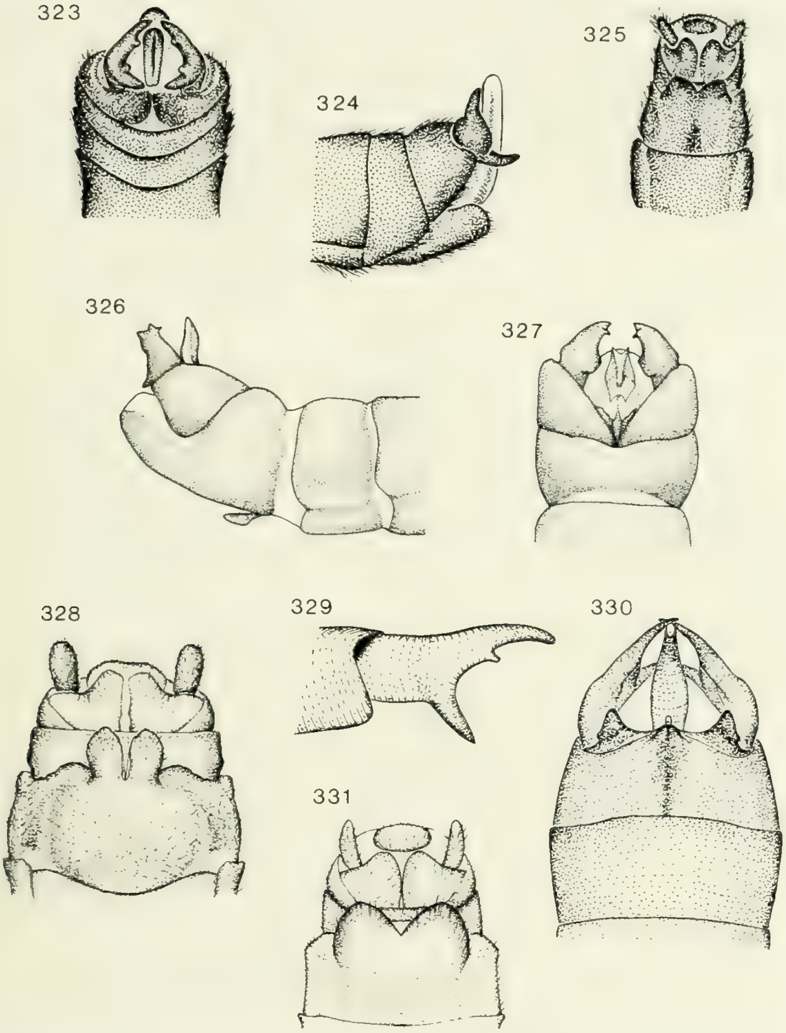
Paraleuctra vershina Gaufin and Ricker (figs. 329-331)

Leuctra occidentalis, Needham and Claassen, 1925, 2: 231, male and female; figs. 6-8, p. 373, male genitalia; fig. 12, p. 375, female genitalia.
Leuctra sara Claassen, 1973b, 10: 44 (in part).
Paraleuctra sara, Hanson, 1941, 36: 58 (in part).
Paraleuctra vershina Gaufin and Ricker, 1975, 85: 285.

Type locality. — City Creek, Salt Lake Co., Utah.

Geographic range. — Coast, Cascade, Rocky and Sierra Nevada Mts.

Distribution in Rocky Mts. — (Canadian, Northern, Central and Southern Rockies): ALBERTA: Banff N. P. BRITISH COLUMBIA: Purcell Range. COLORADO: Boulder Co.; Clear Creek Co.; Delta Co.; Eagle Co.; Grand Co.; Gunnison Co.; Hinsdale Co.; Lake Co.; La Plata Co.; Larimer Co.; Routt Co.; Summit Co. IDAHO: Blaine Co.; Bonner Co.; Custer Co.; Franklin Co.; Fremont Co.; Lemhi Co.; Shoshone Co.;



FIGURES 323-331. — *Paraleuctra forcipata* (Frison): 323, male terminalia, dorsal view; 324, male terminalia, lateral view; 325, female terminalia, ventral view. *Paraleuctra purcellana* (Neave): 326, male terminalia, lateral view; 327, male terminalia, dorsal view; 328, female terminalia, ventral view. *Paraleuctra vershina* (Gaufin and Ricker): 329, cercus; 330, male terminalia, dorsal view; 331, female terminalia, ventral view.

Valley Co. MONTANA: Beaverhead Co.; Carbon Co.; Cascade Co.; Flathead Co.; Gallatin Co.; Glacier Co.; Golden Valley Co.; Granite Co.; Judith Basin Co.; Lake Co.; Lewis and Clark Co.; Lincoln Co.; Missoula Co.; Park Co.; Powell Co.; Ravalli Co.; Sanders Co.; Sweet Grass Co.; Wheatland Co. NEW MEXICO: Rio Arriba Co.; San Miguel Co.; Santa Fe Co.; Taos Co. OREGON: Baker Co.; Umatilla Co. UTAH: Cache Co.; Davis Co.; Summit Co.; Salt Lake Co.; Wasatch Co.; Weber Co. WASHINGTON: Pend Oreille Co. WYOMING: Albany Co.; Fremont Co.; Park Co.; Sublette Co.; Teton Co.

Discussion. — This species occurs abundantly in creeks and rivers. The adults emerge from March to August.

Genus PERLOMYIA Banks 1906

This genus is rare in collections but can be quite common in large springs in the Rocky Mountains.

The cerci of the males are heavily sclerotized and enlarged with blunt prongs near the base (figs. 332, 333). They possess an epiproct but do not have a distinctive titillator. The females have a poorly developed subgenital plate (fig. 334). The eighth sternum is divided mesally but does have small lateral sclerotized patches.

Perlomyia is rarely collected by the casual collector but can be very common if sought in large spring-fed areas in the early spring.

Key to the Species of Perlomyia

Males

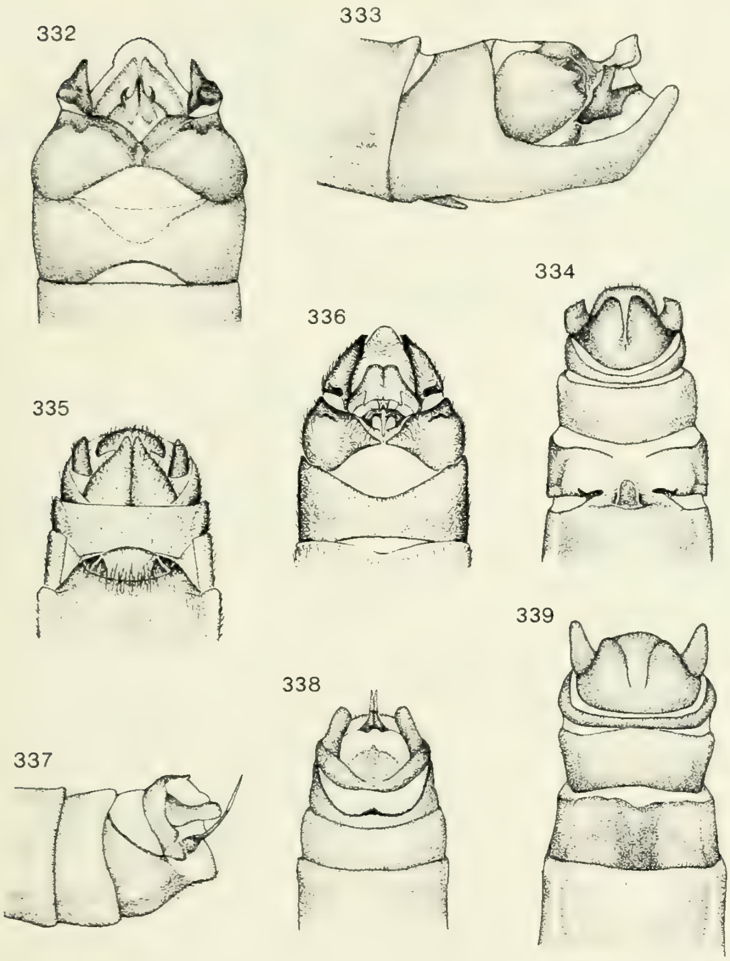
1. Epiproct with slender pointed tip (figs. 332, 333) .... *collaris*
   Epiproct with broad blunt tip (fig. 336) .... *utahensis*

Females

1. Posterior margin of seventh sternum swollen, bearing long hairs (fig. 335) .... *utahensis*
   Posterior margin of seventh sternum only slightly expanded, without long hairs and often nearly naked (fig. 334) .... *collaris*

Perlomyia collaris Banks (figs. 332-334)

Perlomyia collaris Banks, 1906a, 38: 338.
Perlomyia collaris, Needham and Claassen, 1925, 2: 235, female; fig. 6, p. 375, female genitalia.
Perlomyia solitaria Frison, 1936, 29: 161, male; figs. 24-27, p. 264, male genitalia.
Perlomyia sobrina Frison, 1936, 29: 262.
Perlomyia collaris, Jewett, 1954, 11: 545, nymph.



FIGURES 332-339. — *Perlomyia collaris* (Banks): 332, male terminalia, dorsal view; 333, male terminalia, lateral view; 334, female terminalia, ventral view. *Perlomyia utahensis* (Needham and Claassen): 335, female terminalia, ventral view; 336, male terminalia, dorsal view. *Despaxia augusta* (Banks): 337, male terminalia, lateral view; 338, male terminalia, dorsal view; 339, female terminalia, ventral view.

Type locality. — Wellington, British Columbia.

Geographic range. — Coast, Cascade and Rocky Mts.

Distribution in Rocky Mts. — (Northern Rockies): OREGON: Union Co. IDAHO: Nez Perce Co.

Discussion. — This species occurs commonly in creeks and rivers of the Pacific Northwest. The adults emerge from February to April.

Perlomyia utahensis Needham and Claassen (figs. 59, 335, 336)

Perlomyia utahensis Needham and Claassen, 1925, 2: 235, male; figs. 1-2, p. 377, male genitalia.
Perlomyia utahensis, Hoppe, 1938, 4: 163, female.

Type locality. — Logan, Utah.

Geographic range. — Coast, Cascade and Rocky Mts.

Distribution in Rocky Mts. — (Canadian, Northern, Central and Southern Rockies): ALBERTA: Banff N. P. BRITISH COLUMBIA: Summit Lake. COLORADO: Mineral Co. MONTANA: Flathead Co.; Gallatin Co.; Glacier Co.; Golden Valley Co.; Granite Co.; Judith Basin Co.; Lake Co.; Missoula Co. NEW MEXICO: Taos Co. OREGON: Union Co. UTAH: Beaver Co.; Box Elder Co.; Cache Co.; Juab Co.; Millard Co.; Salt Lake Co.; Summit Co. WYOMING: Albany Co.; Sublette Co.

Discussion. — This species inhabits creeks and small rivers but is most common in springs. Emergence occurs from April through July.

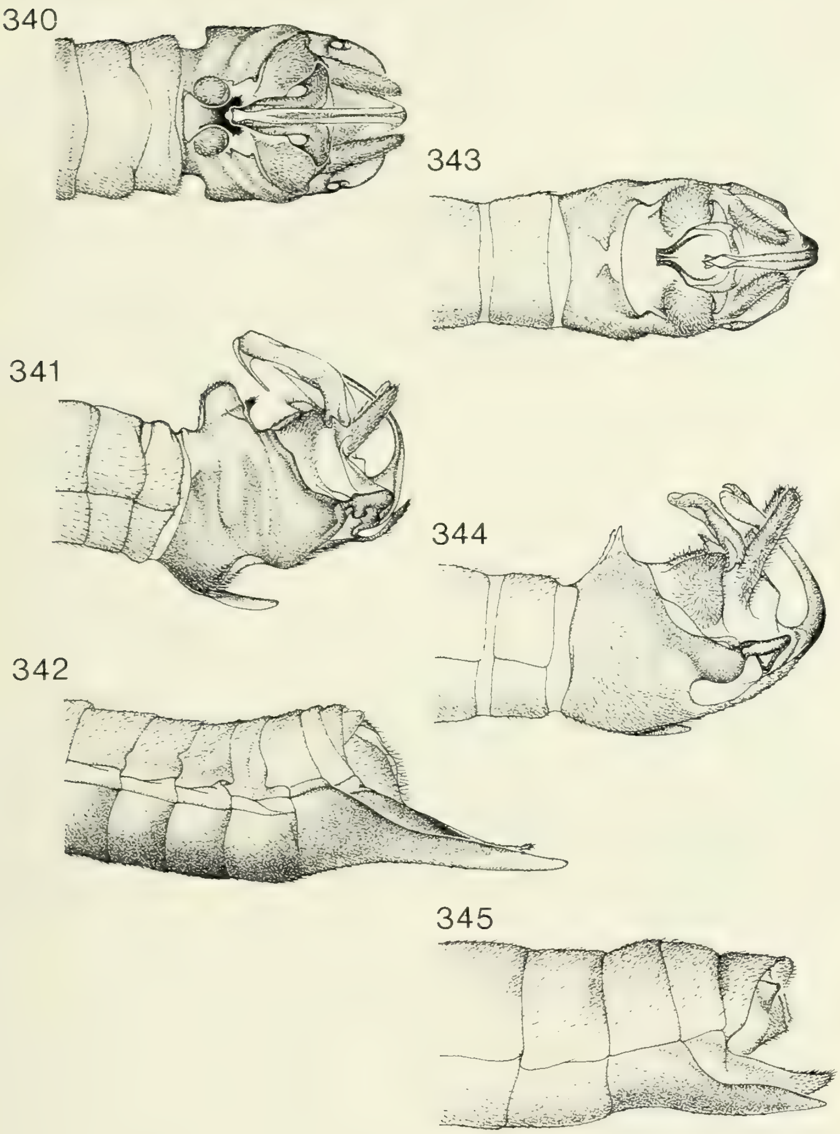
Subfamily Megaleuctrinae

Genus MEGALEUCTRA Neave 1934

This genus contains only five extant species all of which are endemic to North America. Two species have been recorded from the Rocky Mountains but they are seldom collected. The remaining species are found in the Pacific Northwest and the Appalachian Mountains.

The males have very complex terminalia with projections on the ninth tergum and a very large, long titillator (figs. 340, 341). The females have an elongate subgenital plate which complements the titillator of the males (fig. 342).

Nymphs have been collected from springs and seeps which are often very small. They are able to survive in a habitat which includes little more than damp stones and plentiful detritus.



FIGURES 340-345. — *Megaleuctra stigmata* (Banks): 340, male terminalia, dorsal view; 341, male terminalia, lateral view; 342, female terminalia, lateral view. *Megaleuctra kincaidi* (Frison): 343, male terminalia, dorsal view; 344, male terminalia, lateral view; 345, female terminalia, lateral view.

Key to the Species of Megaleuctra

Males

1. Projection on ninth tergum large and broad (figs. 340, 341) .... *stigmata*
   Projection on ninth tergum small and thin (figs. 343, 344) .... *kincaidi*

Females

1. Subgenital plate extending well beyond apex of abdomen (fig. 342) .... *stigmata*
   Subgenital plate extending to apex of abdomen (fig. 345) .... *kincaidi*

Megaleuctra kincaidi Frison (figs. 343-345)

Megaleuctra kincaidi Frison, 1942a, 18: 15, male; fig. 3, p. 12, male genitalia.

Type locality. — Fryingpan Creek, Mt. Rainier, Washington.

Geographic range. — Cascade and Rocky Mountains.

Distribution in Rocky Mts. — (Northern Rockies): IDAHO: Clearwater Co., Lolo Pass.

Discussion. — This rare species has been collected from April to July.

Megaleuctra stigmata (Banks) (figs. 340-342)

Nemoura stigmata Banks, 1900a, 26: 244.

Megaleuctra spectabilis Neave, 1934, 66: 4, female; figs. 6-7, p. 3, wings and female genitalia.

Megaleuctra stigmata, Claassen, 1937b, 10: 47; fig. 15, p. 51, male genitalia.

Type locality. — Winnipeg, British America.

Geographic range. — Northwestern North America.

Distribution in Rocky Mts. — (Canadian and Northern Rockies): ALBERTA: No locality. BRITISH COLUMBIA: Campbell Creek, Purcell Range. MONTANA: Lake Co.; Missoula Co.

Discussion. — This species seems to be restricted to small springs or seeps which are often only damp for part of the year. The adults emerge from April to June.

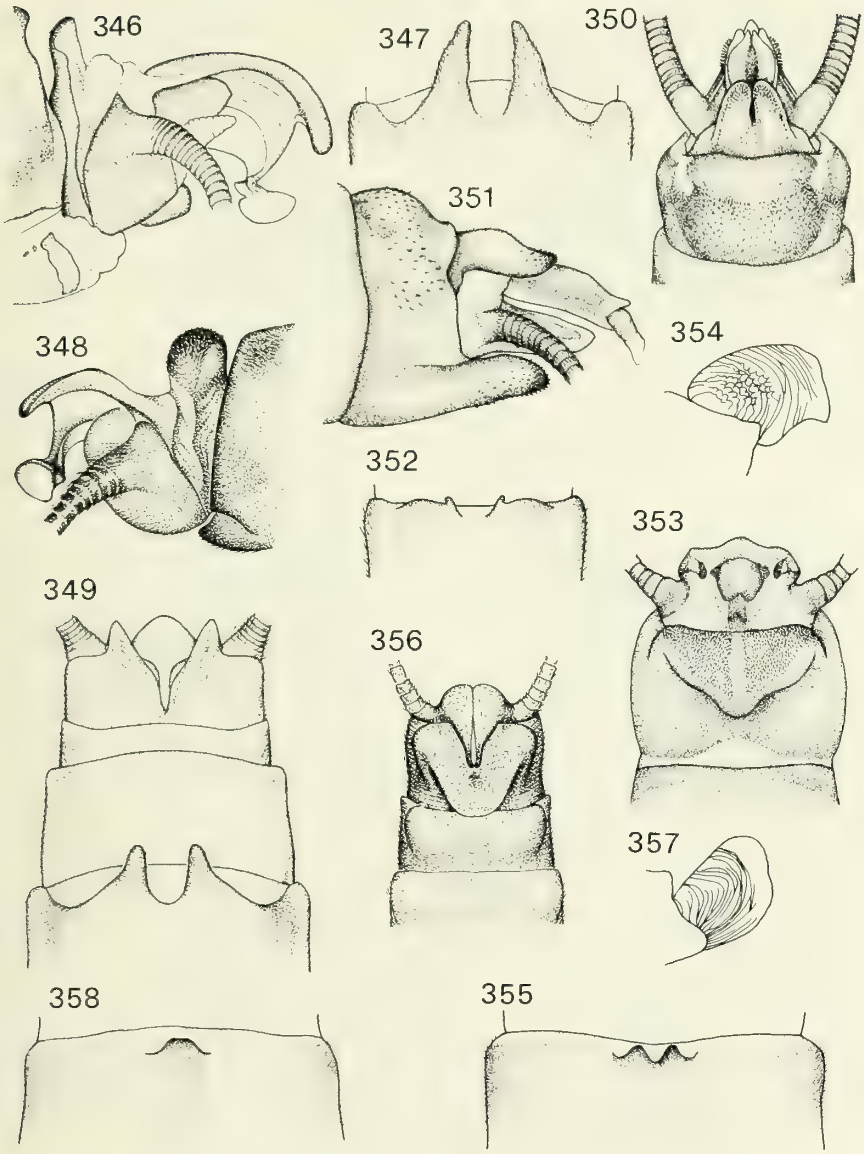
Group Systellognatha

Family **Peltoperlidae**

Genus YORAPERLA Ricker 1952

The adults are small and stout with the head and prothorax much compressed somewhat cockroach-like. The nymphs are dark brown in color and also have a distinct broadly compressed shape (fig. 362). The nymphal sterna are large and overlap each other. One pair of cervical

Figures 346-358. — *Pteronarcys princeps* Banks: 346, male terminalia, lateral view; 347, subgenital plate, female. *Pteronarcys californica* Newport: 348, male



terminalia, lateral view; 349, female terminalia, ventral view. *Pteronarcys dorsata* (Say): 350, male terminalia, dorsal view; 351, male terminalia, lateral view; 352, subgenital plate, female. *Pteronarcella regularis* (Hagen): 353, male terminalia, dorsal view; 354, epiproct, lateral view; 355, subgenital plate, female. *Pteronarcella badia* (Hagen): 356, male terminalia, dorsal view; 357, epiproct, lateral view; 358, subgenital plate, female.

gills and two pairs of lateral gills are present on the thorax. The eggs are greatly flattened and wafer-like in appearance.

Key to the Species of Yoraperla

Males

1. Length to tip of wings 8-10 mm; hammer-like process on ninth sternum only 1½ times as long as wide (fig. 359) .... *brevis*
   Length to tip of wings 11-13 mm; hammer-like process on ninth sternum twice as long as wide (fig. 363) .... *mariana*

Females

1. Length to tip of wings 10-13 mm, groove on subgenital plate shallow (fig. 361) .... *brevis*
   Length to tip of wings 14-16 mm, groove on subgenital plate deep (fig. 364) .... *mariana*

Nymphs

1. Length of mature nymphs 4-6 mm; metasternal plate excavated along posterior margin (fig. 362) .... *brevis*
   Length of mature nymphs 7-10 mm; metasternal plate not excavated along posterior margin .... *mariana*

Yoraperla brevis (Banks) (figs. 359-362, 365, 366)

Peltoperla brevis Banks, 1907b, 39: 328.
Peltoperla brevis, Needham and Claassen, 1925, 2: 171, male and female; figs. 11-13, p. 353, male and female genitalia.
Peltoperla brevis, Ricker, 1943, 12: 46, nymph; fig. 9, p. 48, nymph.
Peltoperla (*Yoraperla*) *brevis,* Ricker, 1952, 18: 157.
Yoraperla brevis, Illies, 1966, 82: 27.

Type locality. — Glacier, British Columbia.

Geographic range. — Coast, Cascade, Rocky and Sierra Nevada Mts.

Distribution in Rocky Mts. — (Canadian and Northern Rockies): ALBERTA: Banff N. P. BRITISH COLUMBIA: Glacier; Kaslo; Kootenay N. P.; Mt. Revelstoke. IDAHO: Blaine Co.; Boise Co.; Idaho Co.; Kootenai Co.; Lemhi Co. MONTANA: Flathead Co.; Gallatin Co.; Glacier Co.; Granite Co.; Lake Co.; Lewis and Clark Co.; Meagher Co.; Missoula Co.; Ravalli Co. OREGON: Baker Co.; Grant Co. WYOMING: Park Co.

FIGURES 359-364. — *Yoraperla brevis* (Banks): 359, male terminalia, ventral view; 360, male terminalia, dorsal view; 361, female terminalia, ventral view; 362, nymph, habitus. *Yoraperla mariana* (Ricker): 363, male terminalia, ventral view; 364, female terminalia, ventral view.

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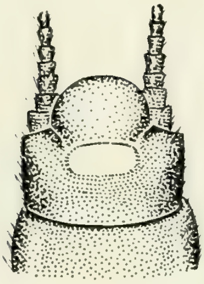

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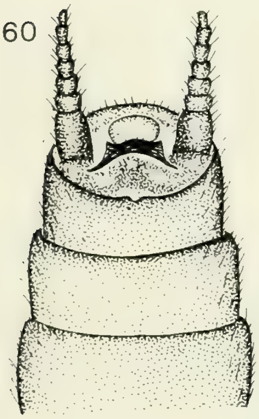

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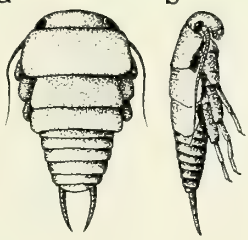

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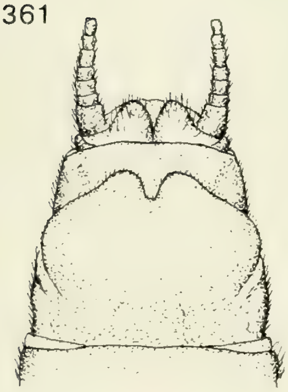

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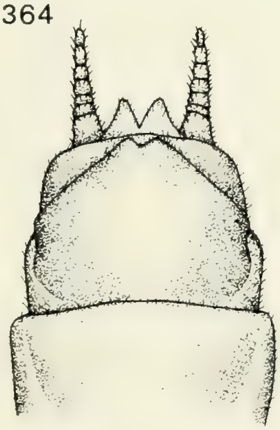

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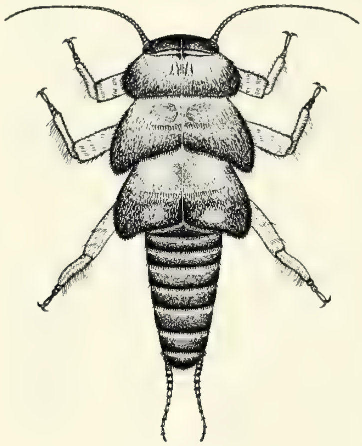

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FIGURES 365-366. — *Yoraperla brevis* (Banks): 365, adult male, habitus; 366, nymph, habitus.

Discussion. — This species is found in springs, creeks and small rivers throughout its range. The adults emerge from April to August.

Yoraperla mariana (Ricker) (figs. 363, 364)

Peltoperla mariana Ricker, 1943, 12: 47, male, female and nymph; figs. 7, 8-11, 12, male, female and nymph.

Peltoperla (Yoraperla) mariana Ricker, 1952, 18: 157.

Yoraperla mariana, Illies, 1966, 82: 27.

Type locality. — Little Liumchin Creek, near Cultus Lake, British Columbia.

Geographic range. — Pacific Northwest.

Discussion. — This species has not been confirmed from the Rocky Mountains although it was recorded by Gaufin et al., 1972, as occurring in Montana. Specimens from Idaho, Montana and Wyoming have been examined which proved to be *Y. brevis.* It is, however, included here because of the possibility that it might occur in the northern Rocky Mountains and because it is the only other named species in the genus *Yoraperla.*

Family **Pteronarcyidae**

Two of the three North American genera in the family Pteronarcyidae, *Pteronarcys* and *Pteronarcella,* are found in the Rocky Mountains. These large dark stoneflies differ from other families in the heavy venation of the anal lobes in the wings (figs. 54, 55). The adult mandibles are rudimentary, but those of the nymph are blunt and heavy (figs. 7-10). The nymphal gills are arranged in pediculate tufts on the thorax and basal abdominal segments (figs. 13, 14). Taxa are distinguished by location of abdominal gills and/or adult genitalia.

Key to the Genera of Pteronarcyidae

Males, Females and Nymphs

1. Abdominal gills or gill remnants on first three segments (fig. 14) .... *Pteronarcella*
   Abdominal gills or gill remnants on first two segments (fig. 13) .... *Pteronarcys*

Genus PTERONARCELLA Banks 1900

The genus *Pteronarcella* includes the smaller members of the family Pteronarcyidae. They are easily separated from *Pteronarcys* by the presence of one additional pair of abdominal gills or gill remnants (fig. 14) and by fewer crossveins in the wings. The ninth tergum of the male is elevated in a broad, transverse and recurved, scoop-like lobe (fig. 353). When at rest, the large, V-shaped epiproct is completely

concealed between the subanal lobes and the divided halves of the tenth tergum (fig. 354).

Key to the Species of Pteronarcella

Males

1. Recurved, scoop-shaped appendage on ninth tergum acutely pointed at apex with side margins straight (fig. 353); with scalloped marks on sides of epiproct (fig. 354) .... *regularis*
   Appendage on ninth tergum broadly rounded at apex, with side margins undulate (fig. 356); no scalloped marks on sides of epiproct (fig. 357) .... *badia*

Females

1. Center of hind margin of subgenital plate acutely notched (fig. 355) .... *regularis*
   Center of hind margin of subgenital plate rounded or truncate, but never notched deeply (fig. 358) .... *badia*

Nymphs

1. Filaments of gill tufts less than twice as long as basal conical processes of gill tufts .... *regularis*
   Filaments of gill tufts at least twice as long as bases of gill tufts .... *badia*

Pteronarcella badia (Hagen) (figs. 14, 32, 356-358)

Pteronarcys badia Hagen, 1874, 7: 573.
Pteronarcella badia, Needham and Claassen, 1925, 2: 46, male and female; figs. 1-2, 6-7, p. 307, male and female genitalia, egg.
Pteronarcella badia, Claassen, 1931, 3: 35, nymph; figure 185, p. 151, nymph.
Pteronarcella badia, Nelson and Hanson, 1971, 97: 131, male and female; figs. 35-37, p. 179, male genitalia; fig. 42, p. 180, female genitalia.

Type locality. — Bridger Basin, Wyoming.

Geographic range. — Rocky Mts. and Alaska.

Distribution in Rocky Mts. — (Canadian, Northern, Central and Southern Rockies): ALBERTA: Banff N. P.; Waterton Lakes N. P. BRITISH COLUMBIA: Kamloops; Kootenay N. P.; Mt. Revelstoke; Selkirk Mts.; Summerland; Vernon. ARIZONA: No locality. COLORADO: Archuleta Co.; Boulder Co.; Conejos Co.; Eagle Co.; El Paso Co.; Grand Co.; Gunnison Co.; Hinsdale Co.; Lake Co.; La Plata Co.; Larimer Co.; Mesa Co.; Montezuma Co.; Montrose Co.; Ouray Co.; Rio Grande Co.; Routt Co.; Saguache Co.; Teller Co. IDAHO: Adams Co.; Bannock Co.; Bonner Co.; Butte Co.; Clark Co.; Custer Co.; Valley Co. MONTANA: Carbon Co.; Cascade Co.; Flathead Co.; Gallatin Co.; Glacier Co.; Granite Co.; Lake Co.; Lewis and Clark Co.; Lincoln Co.; Meagher Co.; Missoula Co.; Park Co.; Powell Co.; Ravalli Co.; Stillwater Co.; Sweet Grass Co.; Yellowstone Co. NEVADA: Humboldt Co.

NEW MEXICO: Colfax Co.; Rio Arriba Co.; Sandoval Co.; San Miguel Co.; Taos Co. OREGON: Baker Co.; Umatilla Co. UTAH: Beaver Co.; Box Elder Co.; Cache Co.; Daggett Co.; Duchesne Co.; Emery Co.; Garfield Co.; Iron Co.; Millard Co.; Salt Lake Co.; Sanpete Co.; Sevier Co.; Summit Co.; Tooele Co.; Uintah Co.; Utah Co.; Wasatch Co.; Washington Co.; Wayne Co.; Weber Co. WYOMING: Albany Co.; Lincoln Co.; Park Co.; Platte Co.; Sublette Co.

Discussion. — The nymphs of this species are very common in creeks and rivers at altitudes below 8500 feet. Their distribution closely parallels that of *Pteronarcys californica.* A two-year life cycle is probable, with the adults emerging from early May to July.

Pteronarcella regularis (Hagen) (figs. 353-355)

Pteronarcys regularis Hagen, 1874, 7: 573.

Pteronarcella regularis, Needham and Claassen, 1925, 2: 44, male and female; figs. 3-5, p. 307, male and female genitalia.

Pteronarcella regularis, Claassen, 1931, 3: 36, nymph; figs. 179-180, p. 148, nymph.

Pteronarcella regularis, Nelson and Hanson, 1971: 97, 128, male and female; figs. 27-29, p. 177, male genitalia; fig. 34, p. 178, female genitalia.

Type locality. — Truckee, Nevada.

Geographic range. — Coast, Cascade, Rocky and Sierra Nevada Mts.

Distribution in Rocky Mts. — (Northern Rockies): OREGON: Wallowa Mts.; Baker Co.

Discussion. — This species is common in creeks and small rivers in the Pacific Northwest. The locality listed from eastern Oregon is the only confirmed record from the area included in this study. The adults emerge from April to June.

Genus PTERONARCYS Newman 1938

Representatives of the genus *Pteronarcys* are the largest Plecoptera found in North America. Of the four Nearctic species, there are two found in the Rocky Mountains. They have two pairs of abdominal gills or gill remnants (fig. 13) and the wings are very heavily veined (figs. 54, 55). The species are best separated by genitalia. In life, the stoneflies are dark brown, with yellow to salmon-red intersegmental markings.

Key to the Species of Pteronarcys

Males

1. Raised lobe of tenth tergum absent (fig. 351) .... *dorsata*
   Raised lobe of tenth tergum present 2
2. Raised lobe of tenth tergum broadly rounded, about as high as wide (fig. 348) .... *californica*
   Raised lobe of tenth tergum narrow, higher than wide (fig. 346) .... *princeps*

Females

1. Processes of subgenital plate reduced to two small humps (fig. 352) .... *dorsata*
   Processes of subgenital plate as long as or longer than width at base 2
2. Processes of subgenital plate longer than width at base (fig. 347) .... *princeps*
   Processes of subgenital plate as long as width at base (fig. 349) .... *californica*

Nymphs

1. Lateral prothoracic teeth long, slender, sharp and strongly directed outward; supra-antennal plate prolonged into a sharp tooth; wing pads pointed .... *californica*
   Lateral prothoracic teeth short, not strongly directed outward, supra-antennal plate blunt; wing pads rounded 2
2. Prothoracic teeth usually as long as wide; ninth sternum of male produced beyond tenth; tenth tergum of female nearly straight .... *dorsata*
   Prothoracic teeth usually shorter than wide; ninth sternum of male narrow and not produced; tenth tergum of female with apex considerably elevated .... *princeps*

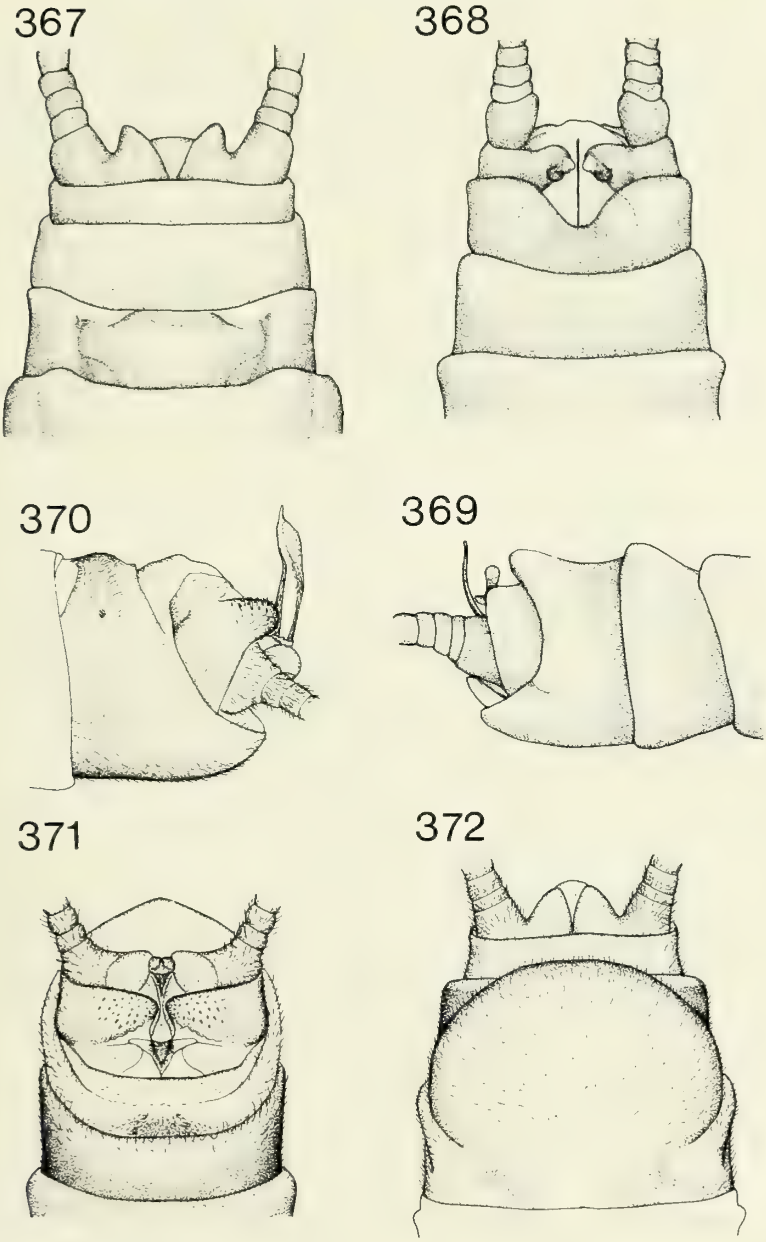
Pteronarcys californica Newport (figs. 7-10, 13, 33, 54, 55, 348, 349)

Pteronarcys californicus Newport, 1848, 20: 450.
Pteronarcys californica, Needham and Claassen, 1925, 2: 37, male and female; figs. 5-6, p. 305, male and female genitalia.
Pteronarcys californica, Claassen, 1931, 3: 32, nymph; fig. 233, p. 192, nymph.

Type locality. — California.

Geographic range. — Coast, Cascade, Rocky and Sierra Nevada Mts.

Distribution in Rocky Mts. — (Canadian, Northern, Central and Southern Rockies): ALBERTA: Crows Nest River. ARIZONA: No locality. BRITISH COLUMBIA: Oliver; Peachland; Quesnel; Savona; Summerland; Vernon; Wells Gray Park; Yahk. COLORADO: Archuleta Co.; Chaffee Co.; Grand Co.; Gunnison Co.; Hinsdale Co.; La Plata Co.; Larimer Co.; Montezuma Co.; Montrose Co.; Rio Blanco Co.; Rio Grande Co.; Routt Co. IDAHO: Bannock Co.; Blaine Co.; Bonner Co.; Bonneville Co.; Butte Co.; Caribou Co.; Clark Co.; Custer Co.; Fremont Co.; Idaho Co.; Latah Co.; Lemhi Co.; Owyhee Co.; Teton Co. MONTANA: Beaverhead Co.; Flathead Co.; Gallatin Co.; Glacier Co.; Granite Co.; Lake Co.; Lewis and Clark Co.; Lincoln Co.; Madison Co.; Missoula Co.; Park Co.; Ravalli Co.; Sweet Grass Co. NEW MEXICO: Colfax Co.; Rio Arriba Co.; San Miguel Co. UTAH: Beaver Co.; Cache Co.; Daggett Co.; Salt Lake Co.; Sevier Co.; Summit Co.; Uintah Co.; Utah Co.; Wasatch Co.; Washington Co.; Wayne Co.; Weber Co. WASHINGTON: Walla Walla Co. WYOMING: Albany Co.; Park Co.; Teton Co.



FIGURES 367-372. — *Arcynopteryx compacta* MacLachlan: 367, female terminalia, ventral view; 368, male terminalia, dorsal view; 369, male terminalia, lateral view. *Pictetiella expansa* (Banks): 370, male terminalia, lateral view; 371, male terminalia, dorsal view; 372, female terminalia, ventral view.

Discussion. — Nymphs of this species generally occur in beds of higher aquatic plants or under large rocks where there is an accumulation of debris. This species has a three to four year life cycle with the adults emerging from mid-April through early August, depending primarily on the temperature and altitude.

Pteronarcys dorsata (Say) (figs. 350-352)

Sialis dorsata Say, 1823, 2: 164.
Pteronarcys regalis Newman, 1838, 5: 176.
Kollaria insignis Pictet, 1841: 123.
Pteronarcys nobilis Hagen, 1861, 4: 15.
Pteronarcys frigida Gerstaecker, 1873: 65.
Pteronarcys rectus Provancher, 1876, 8: 189.
Pteronarcys flavicornis Provancher, 1876, 8: 191.
Pteronarcys shelfordi Frison, 1934, 66: 25.
Pteronarcys dorsata, Nelson and Hanson, 1971, 97: 143, male and female; figs. 93-95, p. 196, male genitalia; fig. 99, p. 197, female genitalia.

Type locality. — Ohio River at Pittsburgh.

Geographic range. — Eastern North America and the northern portion of western North America.

Distribution in Rocky Mts. — (Canadian, Northern and Central Rockies): ALBERTA: Athabasca River. BRITISH COLUMBIA: Prince George. MONTANA: Cascade Co., Missouri River. WYOMING: Albany Co., Laramie.

Discussion. — This species is common in rivers of the central and eastern states where the nymphs live in the accumulated detritus of the eddies below stony rapids. The adults emerge in June and July.

Pteronarcys princeps Banks (figs. 34, 346, 347)

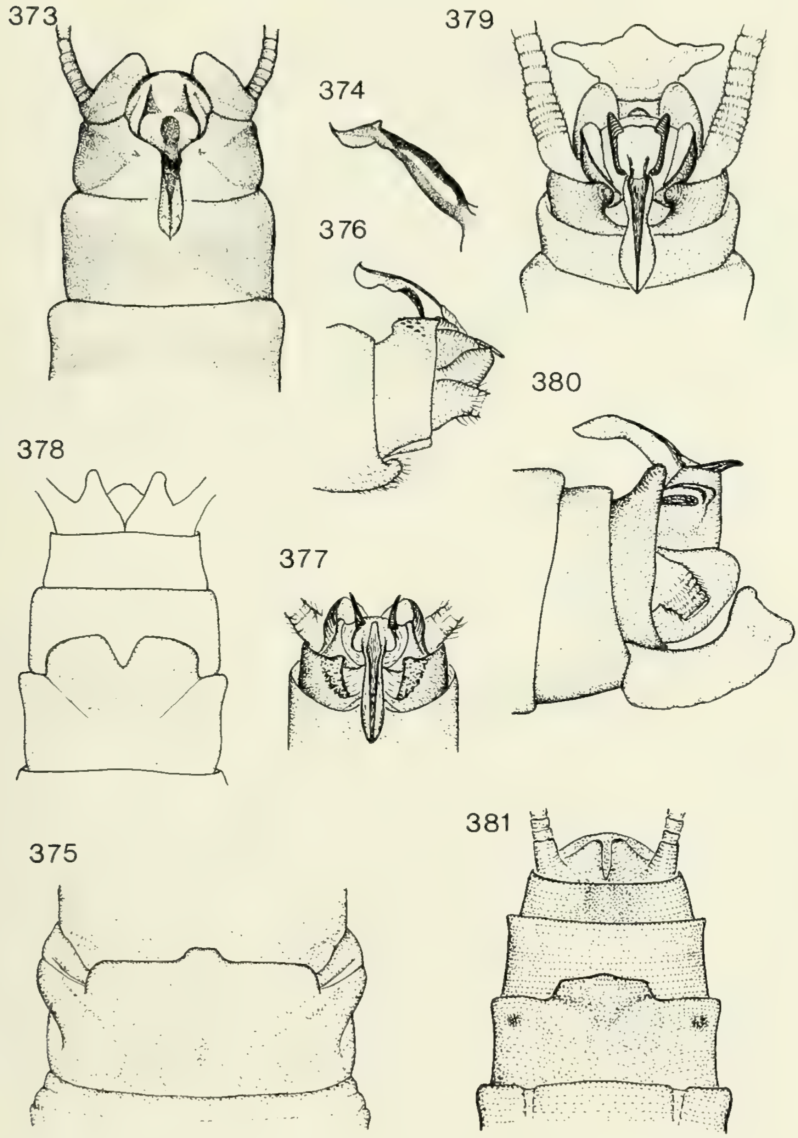
Pteronarcys princeps Banks, 1907b, 39: 327.
Pteronarcys princeps, Needham and Claassen, 1925, 2: 38, male and female; figs. 7-8, p. 305, male and female genitalia.
Pteronarcys princeps, Claassen, 1931, 3: 33, nymph; fig. 238, p. 195, nymph.
Pteronarcys princeps, Nelson and Hanson, 1971, 97: 142, male and female; figs. 86-88, p. 194, male genitalia; fig. 92, p. 195, female genitalia.

Type locality. — Mission, British Columbia.

Geographic range. — Coast, Cascade, Rocky and Sierra Nevada Mts.

Distribution in Rocky Mts. — BRITISH COLUMBIA: Enderby; Vernon. IDAHO: Bannock Co. NEVADA: Elko Co.; Lander Co.; White Pine Co. UTAH: Cache Co.; Juab Co.; Wasatch Co.

Discussion. — The nymphs of this species are abundant in creeks and rivers throughout the Pacific Northwest and California but rare in the Rocky Mountains. The adults emerge from April through June.



FIGURES 373-381. — *Isogenoides elongatus* (Hagen): 373, male terminalia, dorsal view; 374, epiproct, lateral view; 375, female terminalia, ventral view. *Isogenoides colubrinus* (Hagen): 376, male terminalia, lateral view; 377, male terminalia, dorsal view; 378, female terminalia, ventral view. *Isogenoides zionensis* Hanson: 379, male terminalia, dorsal view; 380, male terminalia, lateral view; 381, female terminalia, ventral view.

Family **Perlodidae**

The family Perlodidae is mainly characterized by short glossae on the labium which are reduced to small knobs fused to the sides of the paraglossae (fig. 2). The pointed paraglossae and the absence of branched thoracic gills distinguish the Perlodidae from the family Perlidae. The family differs from the family Chloroperlidae in the more depressed shape of the nymph (figs. 16, 17) and the state of the second anal vein of the forewing; its branches leaving the anal cell separately instead of together (figs. 48, 53).

Three structural features of ancient origin, including the gills, the epiproct and a profusion of crossveins in the apical portion of the wing, have been retained by the more primitive Perlodidae and lost in the more derived representatives. Although gradations in the character states appear within both subfamilies the Isoperlinae are generally considered more advanced than the Perlodinae.

Key to the Subfamilies of Perlodidae

Males

1. Tenth tergum neither cleft nor with membranous notch (fig. 417); gill remnants absent .... *Isoperlinae*
   Tenth tergum cleft or with membranous notch (fig. 368); submental and/or thoracic gill remnants often present .... *Perlodinae*

Females

1. Pronotum with broad, light median stripe, usually with light areas on lateral margins, rugosities mostly simple and coarse; with few crossveins except in *I. phalerata* and the members of the *Clioperla* complex .... *Isoperlinae*
   Pronotum with narrow, light median stripe, lateral margins mostly dark, rugosities often intricate and fine; usually with multiple crossveins .... *Perlodinae*

Nymphs

1. Gills absent; color pattern on abdominal terga as light and/or dark longitudinal stripes .... *Isoperlinae*
   Gills usually present; color pattern on abdominal terga as light and dark bands or concolorous .... *Perlodinae*

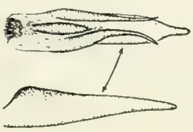
Figures 382-390. — *Cultus aestivalis* (Needham and Claassen): 382, male terminalia, dorsal view; 383a, lateral stylets, dorsal view; 383b, lateral stylet, lateral view; 384, female terminalia, ventral view. *Cultus pilatus* (Frison): 385, male terminalia, dorsal view; 386a, lateral stylet, dorsal view; 386b, lateral stylet, lateral view; 387, female terminalia, ventral view. *Cultus tostonus* (Ricker): 388, male terminalia, dorsal view; 389a, lateral stylet, dorsal view; 389b, lateral stylet, lateral view; 390, female terminalia, ventral view.

382

383

a

b



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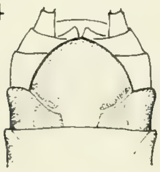

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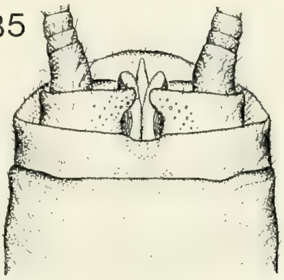

386 a

b

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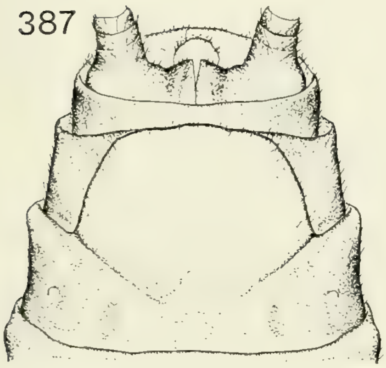

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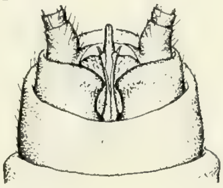
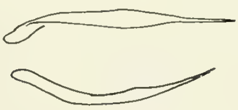


389 a

b



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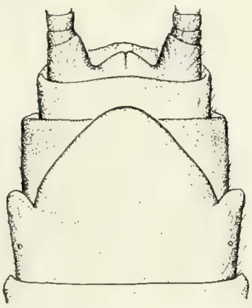

Subfamily Perlodinae

This subfamily includes the remainder of the Perlodidae not belonging to the Isoperlinae. Ricker (1952) recognized the subfamily Isogeniinae but Zwick (1973) stated that there was no reason to recognize both the Perlodinae and Isogeniinae.

Many species in Perlodinae are large and very distinctively marked in both the nymphal and adult stages. The nymphs are basically dark in color which helps to bring out their intricate light-colored dorsal pattern which is usually species specific. The adults are dark brown or black with bright yellow or orange markings on the head and pronotum and the venter is usually light in color.

Gills when present are simple and finger-like and are restricted to the thorax or base of the submentum in Rocky Mountain species. The only exception to this rule in western North America is the Sierra Nevada genus *Oroperla* which has lateral gills on some abdominal segments.

Key to the Genera of Perlodinae

Males

1. Tenth tergum not deeply cleft but with light membranous notch on posterior margin; epiproct absent; paraprocts modified into hook-like lobes (fig. 396) .... *Diura*
   Tenth tergum deeply cleft; epiproct present and well developed; paraprocts not modified (figs. 403, 404) 2
2. Apical crossveins of forewings numerous and irregular (fig. 52); lobe absent from seventh sternum 3
   Apical crossveins few and regular or absent (figs. 50, 53); lobe usually present on seventh sternum 7
3. Large bifid process on seventh tergum (fig. 398) .... *Perlinodes*
   Process absent from seventh tergum 4
4. Gill remnants present on meso- and metathorax, absent from prothorax; arms of mesosternal ridge meet posterior corners of furcal pits (fig. 27) .... *Setvena*
   Gill remnants absent or present on all thoracic segments; arms of mesosternal ridge meet anterior corners of furcal pits (fig. 26) 5
5. Gill remnants present on all three thoracic segments .... *Megarcys*
   Gill remnants absent from thoracic segments 6
6. Epiproct long and needle-like; lateral stylets absent .... *Arcynopteryx*
   Epiproct short and blunt; lateral stylets present .... *Skwala*
7. Mesosternal ridge pattern with median fork that extends to transverse ridge (fig. 29); submental gill remnants elongate (fig. 23) .... *Isogenoides*
   Mesosternal ridge pattern without median fork (fig. 27); submental gill remnants short or absent 8
8. Lateral stylets present (figs. 382, 383) .... *Cultus*
   Lateral stylets absent (fig. 393) 9

9. Submental gill remnants absent; produced apex of epiproct coiled (fig. 392) ... *Kogotus*
Submental gill remnants present; apex of epiproct not coiled (fig. 370) ... *Pictetiella*

Females

1. Arms of mesosternal ridge pattern meet anterior corners of furcal pits (fig. 28) ... 2
Arms of mesosternal ridge pattern meet posterior corners of furcal pits (fig. 27) ... 4
2. Gill remnants present on all three thoracic segments; subgenital plate broadly rounded with narrow, often deep median notch (figs. 402, 406) ... *Megarcys*
Gill remnants absent from thoracic segments; subgenital plate truncate, often with broad shallow median notch or excavation (figs. 367, 412) ... 3
3. Subgenital plate with broad shallow notch (fig. 367) ... *Arcynopteryx*
Subgenital plate truncate or slightly excavated (figs. 412, 415) ... *Skwala*
4. Mesosternal ridge pattern with median fork that extends to transverse ridge (fig. 29) ... *Isogenoides*
Mesosternal ridge pattern without median fork (fig. 27) ... 5
5. Gill remnants present on one or more thoracic segments ... 6
Gill remnants absent from thoracic segments ... 7
6. Gill remnants on all three thoracic segments; submental gills long; subgenital plate deeply notched ... *Perlinodes*
Gill remnants on meso- and metathorax only; submental gills short; subgenital plate broadly rounded ... *Setvena*
7. Mesosternal transverse ridge absent; subgenital plate short and truncate (fig. 397) ... *Diura*
Mesosternal transverse ridge present but sometimes incomplete; subgenital plate large and broadly rounded (fig. 384) ... 8
8. Subgenital plate very large and broad, apex nearly as wide as base (fig. 372) ... *Pictetiella*
Subgenital plate large at base but tapering to rounded apex (fig. 387) ... 9
9. Base of subgenital plate extending almost entire width of eighth sternum (fig. 391) ... *Kogotus*
Base of subgenital plate extending over three fourths width of eighth sternum (figs. 384, 387, 390) ... *Cultus*

Nymphs

1. Maxilla with single terminal spine, lacking spinules or hairs on mesal margin ... *Kogotus*
Maxilla with large main spine and smaller second spine, often with additional small spines or hairs on mesal margin (fig. 4) ... 2
2. Mesosternal ridge pattern with median fork that extends to transverse ridge (fig. 29) ... *Isogenoides*
Mesosternal ridge pattern without median fork (fig. 27) ... 3
3. Arms of mesosternal ridge pattern meet or approach anterior corners of furcal pits (fig. 26) ... 4

Arms of mesosternal ridge pattern meet posterior corners of furcal pits (fig. 27) 6
4. Thoracic gills present .... *Megarcys*
Thoracic gills absent 5
5. Denticles on cusps of nymphal mandibles sparse or absent .... *Arcynopteryx*
Denticles on cusps of nymphal mandibles numerous .... *Skwala*
6. Thoracic gills present 7
Thoracic gills absent 8
7. Gills present on all three thoracic segments; cervical gills present .... *Perlinodes*
Gills absent from prothorax; cervical gills absent .... *Setvena*
8. Submental gills absent .... *Cultus*
Submental gills present but short 9
9. Pronotum with median longitudinal row of light hairs; apex of cerci dark brown or black .... *Pictetiella*
Pronotum without median hairs; cerci uniformly light brown throughout length .... *Diura*

Genus ARCYNOPTERYX Klapalek 1904

This genus is represented by a single species in the Rocky Mountains. Wing lengths vary from macropterous to micropterous in both sexes but the males are usually micropterous or brachypterous and the females macropterous. Males can be distinguished by the long, thin needle-like apex of the epiproct. Females captured alone are difficult to separate from females of the genus *Skwala.* Actually *Arcynopteryx* is found in the Rocky Mountains only in areas at northern latitudes and in alpine zones at high elevations. Nymphs are also very similar to *Skwala* nymphs and must be separated by hair pattern differences on the mandibles.

Arcynopteryx compacta is the common large perlodid in far northern localities and can be very common in lakes with rocky shorelines.

Arcynopteryx compacta (MacLachlan) (figs. 367-369)

Dictyopteryx compacta MacLachlan, 1872, 15: 54.
Arcynopteryx americana Klapalek, 1912, 4: 21.
Arcynopteryx minor Klapalek, 1912, 4: 22.
Perlodes slossonae Banks, 1914, 66: 608.
Arcynopteryx lineata Smith, 1917, 43: 476.
Arcynopteryx ignota Smith, 1917, 43: 479.
Arcynopteryx inornata Smith, 1917, 43: 480.
Perlodes margarita Alexander, 1936, 31: 24.
Arcynopteryx minor, Hanson, 1942, 28: 396, male and female; fig. 21, p. 406, male genitalia.
Perlodes minor, Frison, 1942, 22: 287; fig. 55, p. 288, female genitalia.
Arcynopteryx compacta, Brinck, 1949, 11: 58.

Type locality. — Siberia.

Geographic range. — Transcontinental in the arctic region.

Distribution in Rocky Mts. — (Northern and Central Rockies): COLORADO: Listed by Ricker (1952); MONTANA: Flathead Co., Hidden Lake, Glacier N. P.; Glacier Co., Glenns Lake, Glenns Lake outlet, Glacier N. P. WYOMING: Park Co., Yellowstone N. P.

Discussion. — The nymphs are found in lakes or rivers associated with lakes in the Rocky Mountains. The adults emerge from March through May.

Genus CULTUS Ricker 1952

The genus *Cultus* is comprised of small to medium-sized stoneflies, yellow in color and lacking all gills and gill remnants. There are one to four crossveins in the costal space of the wing and usually none beyond (fig. 53). The mesosternal ridge pattern of both adult and nymph is typical, although some nymphs lack the transverse ridge. The lobes of the tenth tergum of the male are short, rounded and spinulose (fig. 382). The subgenital plate of the female is long and rounded (fig. 384). The three Rocky Mountain species are distinguished on the basis of color pattern, lateral stylets of the males and subgenital plate of the females.

Key to the Species of Cultus

Males

1. Length of body 12-14 mm; lateral stylets with narrow apex and broad base (fig. 383) .... *pilatus*
   Length of body 8-10 mm; lateral stylets narrow throughout length (figs. 386, 389) 2
2. Head yellow except for brown V-shaped line joining ocelli; abdomen yellow with red tinge .... *tostonus*
   Head brown except for yellow spots behind ocelli and near apex; abdomen brown .... *aestivalis*

Females

1. Length of body 13-15 mm; subgenital plate with broad truncate apex ...... *pilatus*
   Length of body 11-12 mm; subgenital plate with narrow rounded apex 2
2. Head yellow except for brown V-shaped line joining ocelli; abdomen yellow; subgenital plate with slightly pointed apex (fig. 390) .... *tostonus*
   Head brown except for yellow spots behind ocelli and near apex; abdomen brown; subgenital plate with broadly rounded apex (fig. 384) .... *aestivalis*

Cultus aestivalis (Needham and Claassen) (figs. 6a, 382-384)

Perla aestivalis Needham and Claassen, 1925, 2: 87, male and female; figs. 7-10, p. 327, male and female genitalia, egg.
Perla aestivalis, Claassen, 1931, 3: 53, nymph.
Diploperla fraseri Ricker, 1943, 12: 106.

Isogenus (Cultus) aestivalis, Ricker, 1952, 18: 96.
Cultus aestivalis, Illies, 1966, 82: 355.

Type locality. — Yellowstone National Park.

Geographic range. — Coast, Cascade and Rocky Mts.

Distribution in Rocky Mts. — (Canadian, Northern, Central and Southern Rockies): BRITISH COLUMBIA: Fort St. John; Prince George. ARIZONA: Apache Co. COLORADO: Archuleta Co.; El Dorado Co.; Garfield Co.; Grand Co.; Rio Blanco Co.; Routt Co.; Saguache Co. IDAHO: Fremont Co.; Idaho Co.; Lemhi Co.; Teton Co. MONTANA: Lake Co.; Park Co.; Ravalli Co. NEW MEXICO: San Juan Co. UTAH: Duchesne Co.; Garfield Co.; Salt Lake Co.; Summit Co.; Wasatch Co.; Weber Co. WYOMING: Albany Co.; Sheridan Co.; Teton Co.

Discussion. — This species is common in the creeks and rivers where it has been collected. The adults emerge from April to August.

Cultus pilatus (Frison) (figs. 385-387)

Diploperla pilata Frison, 1942b, 22: 305, male, female and nymph; fig. 78, p. 306, male and female genitalia; fig. 79, p. 307, nymph.
Isogenus (Cultus) pilatus, Ricker, 1952, 18: 97.
Cultus pilatus, Illies, 1966, 82: 356.

Type locality. — Vedder Crossing, British Columbia.

Geographic range. — Coast, Cascade and Rocky Mts.

Distribution in Rocky Mts. — (Canadian, Northern and Central Rockies): BRITISH COLUMBIA: Oliver. COLORADO: Larimer Co. IDAHO: Blaine Co.; Fremont Co.; Idaho Co. MONTANA: Flathead Co.; Glacier Co.; Granite Co.; Lake Co.; Lewis and Clark Co.; Ravalli Co.; Missoula Co.

Discussion. — This species is found in creeks and rivers. The adults emerge from April to mid-August.

Cultus tostonus (Ricker) (figs. 53, 388-390)

Diploperla aestivalis, Ricker, 1943 (not Needham and Claassen, 1925), 12: 107; fig. 89, p. 107, male genitalia.
Isogenus (Cultus) tostonus Ricker, 1952, 18: 97, male and female; fig. 52, p. 102, female genitalia.
Cultus tostonus, Illies, 1966, 82: 357.

Type locality. — Toston, Montana.

Geographic range. — Coast, Cascade, Rocky and Sierra Nevada Mts.

Distribution in Rocky Mts. — (Canadian, Northern and Central Rockies): BRITISH COLUMBIA: Oliver. IDAHO: Bannock Co.; Boise Co.; Fremont Co.; Lemhi Co.; Nez Perce Co. MONTANA: Beaverhead Co.; Broadwater Co.; Carbon Co.; Cascade Co.; Fergus Co.; Flathead Co.;

Gallatin Co.; Glacier Co.; Jefferson Co.; Lake Co.; Lewis and Clark Co.; Lincoln Co.; Madison Co.; Missoula Co.; Park Co.; Ravalli Co.; Silver Bow Co.; Stillwater Co.; Sweet Grass Co. WYOMING: Lincoln Co.; Park Co.; Sheridan Co.; Sublette Co.

Discussion. — This species is found in creeks and rivers. The adults emerge from April to August.

Genus DIURA Billberg 1820

The genus *Diura* is composed of medium-sized, light brown stoneflies with short, conical submental gills. The mesosternal ridge pattern of both adults and nymphs lacks the transverse ridge and the arms of the Y-ridge join the posterior corners of the furcal pits. Males are unique within the subfamily because they lack an epiproct (fig. 396). The tenth tergum of the male bears a membranous median triangle on the posterior edge and a few spinules on the dorsal surface. The subgenital plate of the female is briefly produced and truncate or slightly excavated (fig. 397). Only one species of *Diura* is recorded from the Rocky Mountains. The nymph is brightly colored with brown and yellow transverse stripes on the abdomen.

Diura knowltoni (Frison) (figs. 6b, 40, 396, 397)

Dictyopterygella knowltoni Frison, 1937, 21: 89; fig. 78, p. 90, male genitalia.
Dictyopterygella knowltoni Frison, 1942b, 22: 299, female and nymph; figs. 72-73, p. 300, female genitalia and nymph.
Diura (*Dolkriia*) *knowltoni*, Ricker, 1952, 18: 138.

Type locality. — Logan, Utah.

Geographic range. — Coast, Cascade, Rocky and Sierra Nevada Mts.

Distribution in Rocky Mts. — (Canadian, Northern, Central and Southern Rockies): ALBERTA: Banff N. P. BRITISH COLUMBIA: Penticton. COLORADO: Chaffee Co.; Grand Co.; Gunnison Co.; Hinsdale Co.; Larimer Co.; Mineral Co.; Moffat Co.; Routt Co. IDAHO: Bannock Co.; Bear Lake Co.; Custer Co.; Franklin Co.; Fremont Co.; Idaho Co. MONTANA: Flathead Co.; Gallatin Co.; Granite Co.; Lake Co.; Lewis and Clark Co.; Missoula Co.; Powell Co. NEW MEXICO: Rio Arriba Co.; Taos Co. UTAH: Cache Co.; Davis Co.; Duchesne Co.; Piute Co.; Salt Lake Co.; Utah Co.; Wasatch Co. WYOMING: Albany Co.; Teton Co.

Discussion. — This species is found in creeks and rivers but is seldom common. The adults emerge from April to June.

Genus ISOGENOIDES Klapalek 1912

The large dark stoneflies of the genus *Isogenoides* are distinguished from all other perlodids by their mesosternal ridge pattern. Both adults and nymphs have a median ridge connecting the transverse ridge to the fork of the Y-ridge (figs. 23, 29). The tenth tergum of the male is completely cleft and the epiproct is slender with a terminal or subterminal backwardly directed sclerotized or membranous hook or hooks (figs. 376, 377). Ventral lobes are well developed on the seventh segment. The epiproct and subgenital plate are used to differentiate the three Rocky Mountain species. Nymphs are similar but vary in the serration of the mandibles.

This genus is usually found in large rivers but does occur in large creeks at the headwaters of rivers. Nymphs of *Isogenoides* seem to be well adapted to life in large silty rivers because they are the only large perlodids found in the lower reaches.

Key to the Species of Isogenoides

Males

1. Apical hook present at tip of epiproct (figs. 374, 376) 2
   Apical hook absent from tip of epiproct (fig. 380) .... *zionensis*
2. Epiproct with pair of short subapical hooks posterior to apex (fig. 374) .... *elongatus*
   Epiproct without subapical hooks posterior to apex (fig. 376) .... *colubrinus*

Females

1. Subgenital plate with deep V-shaped median notch (fig. 378) .... *colubrinus*
   Subgenital plate truncate, without median notch (figs. 375, 381) 2
2. Subgenital plate almost as wide as eighth sternum, posterior margin straight or bearing small median projection (fig. 375) .... *elongatus*
   Subgenital plate only about one third width of eighth sternum, posterior margin usually nearly straight (fig. 381) .... *zionensis*

Nymphs

1. Conspicuous denticles present along margins on ventral cusps of both mandibles (fig. 5) 2
   Denticles present along margin on ventral cusp of right mandible only .... *colubrinus*
2. Body color dark brown .... *elongatus*
   Body color very light, almost yellow .... *zionensis*

Isogenoides colubrinus (Hagen) (figs. 376-378)

Isogenus colubrinus Hagen, 1874, 7: 576.
Isogenus titusi Banks, 1918, 42: 6.
Isogenus incesta Banks, 1920, 64: 318.
Isogenoides frontalis, Hanson, 1943b, 29: 660, male and female; fig. 3, p. 667, male genitalia; figs. 17-18, p. 668, female genitalia.
Isogenus (Isogenoides) frontalis colubrinus, Ricker, 1952, 18: 110.
Isogenoides colubrinus, Illies, 1966, 82: 363.

Type locality. — Snake River, Idaho.

Geographic range. — Coast, Cascade and Rocky Mts.

Distribution in Rocky Mts. — (Canadian, Northern, Central and Southern Rockies): BRITISH COLUMBIA: Mt. Revelstoke; Pouce Coupe; Prince George; Quesnel; Rolla; Savona; Summit Lake. COLORADO: Archuleta Co.; Gunnison Co.; Hinsdale Co.; Moffat Co.; Routt Co. IDAHO: Bingham Co.; Bonner Co. MONTANA: Glacier Co.; Lincoln Co. UTAH: Garfield Co.; San Juan Co.; Uintah Co.; Weber Co. WYOMING: Teton Co.

Discussion. — This species inhabits large rivers. The adults emerge from March to August.

Isogenoides elongatus (Hagen) (figs. 6c, 23, 373-375)

Isogenus elongatus Hagen, 1874, 7: 576.
Isogenoides elongatus, Hanson, 1942, 29: 660, male and female; fig. 6, p. 667, male genitalia; figs. 11-12, p. 668, female genitalia.
Isogenus (Isogenoides) elongatus, Ricker, 1952, 18: 108.
Isogenoides elongatus, Illies, 1966, 82: 364.

Type locality. — Colorado.

Geographic range. — Coast, Cascade and Rocky Mts.

Distribution in Rocky Mts. — (Northern, Central and Southern Rockies): BRITISH COLUMBIA: Oliver. ARIZONA: Apache Co.; Navajo Co. COLORADO: Archuleta Co.; Boulder Co.; Conejos Co.; Gunnison Co.; Hinsdale Co.; Larimer Co.; Mesa Co.; Moffat Co.; Montrose Co.; Ouray Co.; Routt Co.; Saguache Co. IDAHO: Bonner Co.; Bonneville Co.; Lemhi Co.; Teton Co. MONTANA: Broadwater Co.; Cascade Co.; Gallatin Co.; Mineral Co.; Missoula Co.; Park Co.; Ravalli Co.; Stillwater Co.; Treasure Co. NEW MEXICO: Colfax Co.; Lincoln Co.; San Miguel Co. UTAH: Summit Co.; Utah Co.; Weber Co. WYOMING: Teton Co.

Discussion. — This species is often associated with *Isogenoides colubrinus.* It is common in rivers and large creeks. The adults emerge from May to July.

Isogenoides zionensis Hanson (figs. 2-5, 29, 379-381)

Isogenoides zionensis Hanson, 1949, 44: 109, male; fig. 3, p. 115, male genitalia.
Isogenoides zionensis, Baumann, 1973, 33: 95-96, female, nymph and egg; fig. 10, p. 96, nymph; figs. 12a-12d, p. 100, egg.

Type locality. — Zion National Park, Utah.

Geographic range. — Rocky Mts. and Alaska.

Distribution in Rocky Mts. — (Northern and Southern Rockies): COLORADO: Gunnison Co. NEW MEXICO: Catron Co.; McKinley Co.; Rio Arriba Co.; Taos Co. UTAH: Carbon Co.; Duchesne Co.; Emery Co.; Garfield Co.; Kane Co.; Utah Co.; Washington Co.; Wayne Co.

Discussion. — Nymphs are sometimes common in creeks and rivers in the Southern Rockies, but few adults have been collected. The adults emerge in May and June.

Genus KOGOTUS Ricker 1952

The stoneflies of the genus *Kogotus* are small to medium in size and vary from yellow to dark-brown in color. Submental gills are indistinguishable and the wings bear no crossveins beyond the cord. The mesosternal ridge pattern of the adult is typical but the nymph lacks the transverse ridge (fig. 27). The epiproct is unique among the Perlodidae, with the tip of the anterior band coiled within and evident in lateral aspect (fig. 392). The lateral stylets are absent (fig. 393) and the subgenital plate of the female is long and rounded (fig. 391). Nymphs are easily recognized by their unique unicuspid maxillae. The two species found in the Rocky Mountains are very similar and the females and nymphs are nearly inseparable.

Key to the Species of Kogotus

Males

1. Projecting tips of lobes on tenth tergum slightly longer than shortest cercal segment (fig. 394) .... *nonus*
   Projecting tips of lobes on tenth tergum less than half as long as shortest cercal segment (fig. 393) .... *modestus*

Females

1. Median pronotal stripe separated from dark lateral discs .... *nonus*
   Median pronotal stripe diffusely confluent with dark lateral discs .... *modestus*

Kogotus modestus (Banks) (figs. 27, 391-393)

Perla modesta Banks, 1908, 34: 255.
Perla modesta, Needham and Claassen, 1925, 2: 88, male and female; figs. 16-19, p. 324, male and female genitalia.
Diploperla modesta, Frison, 1942b, 22: 303, nymph; figs. 76-77, nymph.
Isogenus (*Kogotus*) *modestus,* Ricker, 1952, 18: 116.
Kogotus modestus, Illies, 1966, 82: 368.

Type locality. — Boulder, Colorado.

Geographic range. — Coast, Cascade and Rocky Mts.

Distribution in Rocky Mts. — (Northern, Central and Southern Rockies): COLORADO: Boulder Co.; Clear Creek Co.; Eagle Co.; Gilpin Co.; Gunnison Co.; Hinsdale Co.; Larimer Co.; Park Co.; Rio Blanco Co.; Routt Co.; Summit Co.; Teller Co. IDAHO: Bonneville Co.; Custer Co.; Teton Co. MONTANA: Beaverhead Co.; Flathead Co.; Gallatin Co.; Glacier Co.; Granite Co.; Lake Co.; Lincoln Co.; Mineral Co.; Missoula Co.; Ravalli Co. NEW MEXICO: San Miguel Co.; Taos Co. UTAH: Cache Co.; Salt Lake Co.; San Juan Co.; Wasatch Co. WYOMING: Albany Co.; Lincoln Co.; Park Co.; Sublette Co.

Discussion. — This species is common in creeks and rivers. The adults emerge from April to August.

Kogotus nonus (Needham and Claassen) (figs. 394, 395)

Perla nona Needham and Claassen, 1925, 2: 86, female; fig. 21, p. 325, female genitalia.
Perla nona, Claassen, 1937b, 10: 49, male; figs. 5, 15, p. 51, male genitalia.
Isogenus (*Kogotus*) *nonus,* Ricker, 1952, 18: 116.
Kogotus nonus, Illies, 1966, 83: 268.

Type locality. — Corvallis, Oregon.

Geographic range. — Coast, Cascade and Rocky Mts.

Distribution in Rocky Mts. — (Northern and Central Rockies): IDAHO: Blaine Co.; Bonner Co. MONTANA: Gallatin Co.; Glacier Co.; Powell Co.; Missoula Co.; Flathead Co. OREGON: Wallowa Co. WYOMING: Teton Co.

Discussion. — This species is found in creeks and rivers. The adults emerge from April to September.

Genus MEGARCYS Klapalek 1912

The three Rocky Mountain species of the genus *Megarcys* are large, light-brown stoneflies. They are similar to *Arcynopteryx* in the appearance of the mesosternal ridge pattern in that the arms of the Y-ridge join the anterior angles of the furcal pits (figs. 26, 28). *Megarcys* is unique, however, in bearing long submental gills, three pairs of thoracic gills, and

no cervical gills. The tenth tergum of the male is deeply cleft with long, flat upcurved posterior lobes (fig. 404). The subgenital plate of the female varies in length but is characterized by a narrow median notch of various depths (fig. 402). Females and nymphs are difficult to identify to species except by studying mature eggs.

Key to the Species of Megarcys

Males

1. Tips of lateral stylets blunt, with small posteriorly-directed subacute process on posterior corner (figs. 405, 407) .... *subtruncata*
   Tips of lateral stylets narrowed gradually to terminal spine (fig. 400) 2
2. Anterior-posterior length of spinule patch on ninth tergum little greater medially than on lateral knobs (fig. 400) .... *watertoni*
   Length of spinule patch at least one and one half times greater medially than on lateral knobs (fig. 404) .... *signata*

Females

1. Subgenital plate long, nearly as long as eighth segment, with deep, median notch (fig. 402) .... *signata*
   Subgenital plate about half as long as eighth segment with shallow indentation medially (figs. 401, 406) 2
2. Mature egg with eight longitudinal ridges .... *watertoni*
   Mature egg without longitudinal ridges (fig. 39) .... *subtruncata*

Megarcys signata (Hagen) (figs. 26, 28, 402-404)

Dictyopteryx signata Hagen, 1874, 7: 575.
Perlodes signata, Needham and Claassen, 1925, 2: 55, male and female; figs. 6-10, p. 299, male genitalia; fig. 8, p. 309, female genitalia.
Perlodes signata, Claassen, 1931, 3: 43, nymph; figs. 181-182, p. 149, nymph.
Megarcys signata, Smith, 1917, 18: 472.
Megarcys signata, Hanson (in part), 1942, 28: 398, male and female; figs. 9, 16, p. 405, head and female genitalia; fig. 23, p. 405, male genitalia.
Arcynopteryx (*Megarcys*) *signata,* Ricker, 1952, 18: 75.
Megarcys signata, Illies, 1966, 82: 371.

Type locality. — Colorado.

Geographic range. — Coast, Cascade and Rocky Mts.

Distribution in Rocky Mts. — (Canadian, Northern, Central and Southern Rockies): BRITISH COLUMBIA: Dawson Creek; Glacier N. P.; Kaslo; Radium; Selkirk Mts.; Summit Lake. COLORADO: Boulder Co.; Clear Creek Co.; Custer Co.; Dolores Co.; Gilpin Co.; Grand Co.; Gunnison Co.; Hinsdale Co.; La Plata Co.; Larimer Co.; Mineral Co.; Moffat Co.; Ouray Co.; Park Co.; Routt Co.; San Juan Co.; Summit Co. IDAHO: Bannock Co.; Blaine Co.; Bonneville Co.; Butte

Co.; Custer Co.; Franklin Co.; Fremont Co.; Teton Co. MONTANA: Flathead Co.; Gallatin Co.; Glacier Co.; Granite Co.; Lake Co.; Meagher Co.; Missoula Co.; Ravalli Co. NEW MEXICO: Santa Fe Co.; Taos Co. UTAH: Daggett Co.; Davis Co.; Duchesne Co.; Garfield Co.; Iron Co.; Salt Lake Co.; San Juan Co.; Summit Co.; Tooele Co.; Utah Co.; Wasatch Co.; Weber Co. WYOMING: Albany Co.; Carbon Co.; Teton Co.

Discussion. — This species is common in creeks and rivers. The adults emerge from April through August.

Megarcys subtruncata (Needham and Claassen) (figs. 405-407)

Perlodes irregularis, Needham and Claassen (not *irregularis* Banks 1900), 1925, 2: 58, male and female; fig. 24, p. 305, female genitalia; fig. 7, p. 311, male genital hook.

Megarcys subtruncata Hanson, 1942, 28: 400, male and female; fig. 17, p. 405, female genitalia; fig. 24, p. 406, male genitalia.

Arcynopteryx (*Signata*) *subtruncata,* Ricker, 1943, 12: 111, nymph; fig. 91, p. 115, nymph.

Megarcys subtruncata, Illies, 1966, 82: 371.

Type locality. — Paradise Valley, Mt. Rainier, Washington.

Geographic range. — Coast, Cascade and Rocky Mts.

Distribution in Rocky Mts. — (Northern Rockies): IDAHO: Bonner Co., Trestle Cr.; Lemhi Co., Salmon R. (North Fk.); Shoshone Co., Big Cr. MONTANA: Flathead Co., Paola Cr.; Gallatin Co., Cascade Cr.; Hyalite Cr.

Discussion. — This species is found in creeks and rivers. The adults emerge from April to July.

Megarcys watertoni (Ricker) (figs. 400, 401)

Arcynopteryx (*Megarcys*) *watertoni* Ricker, 1952, 18: 77, male, female and nymph; fig. 37, p. 76, male genitalia.

Megarcys watertoni, Illies, 1966, 82: 372.

Type locality. — Pass Creek, Waterton Lakes National Park, Alberta.

Geographic range. — Rocky Mts.

Distribution in Rocky Mts. — (Canadian and Northern Rockies): ALBERTA: Banff N. P.; Waterton Lakes N. P. BRITISH COLUMBIA: Kaslo; Kootenay N. P.; Yoho N. P. IDAHO: Bonner Co.; Boundary Co.; Custer Co.; Lemhi Co. MONTANA: Carbon Co.; Cascade Co.; Flathead Co.; Gallatin Co.; Glacier Co.; Granite Co.; Lake Co.; Mineral Co.; Missoula Co.; Park Co.; Ravalli Co.; Sweet Grass Co.

Discussion. — The nymphs of this species are found in fast flowing creeks. The adults emerge from April to August.

Genus PERLINODES Needham and Claassen 1925

The distinctive species, *Perlinodes aurea* is the only representative of this genus. It is characterized by long submental gills, a pair of cervical gills and three pairs of thoracic gills. The mesosternal ridge pattern is typical except for the centrally incomplete transverse ridge. The male seventh tergum bears a large raised bifid process (fig. 398). The epiproct is flattened, laterally expanded and notched at the tip. The subgenital plate is moderately produced, swollen and deeply notched (fig. 399). The nymphs look much like those of the genus *Pictetiella* but can be distinguished by the presence of thoracic gills.

Perlinodes aurea (Smith) (figs. 398, 399)

Arcynopteryx aurea Smith, 1917, 43: 477, female; fig. 49, pl. 33, female genitalia.
Arcynopteryx vagans Smith, 1917, 43: 478, male; figs. 50-51, pl. 33, male genitalia.
Perlodes aurea, Needham and Claassen, 1925, 2: 62.
Arcynopteryx (Perlinodes) aurea, Ricker, 1952, 18: 80, nymph.
Perlinodes aurea, Illies, 1966, 82: 374.

Type locality. — California.

Geographic range. — Coast, Cascade, Rocky and Sierra Nevada Mts.

Distribution in Rocky Mts. — (Canadian, Northern and Central Rockies): ALBERTA: Lusk Cr. IDAHO: Idaho Co., Fish Cr.; Latah Co., Palouse R., Laird Park. MONTANA: Granite Co., Ranch Cr.; Rock Cr.; Missoula Co., Bitterroot R.; Rock Cr.; Ravalli Co., Bitterroot R. WYOMING: Teton Co., Gros Ventre R.

Discussion. — This rare species is found in creeks and small rivers. The adults emerge from March to June.

Genus PICTETIELLA Illies 1966

The large, light-brown stoneflies of the genus *Pictetiella* bear short submental gills but no thoracic gills. The transverse ridge of the mesosternal ridge pattern is centrally interrupted in the adult and absent in the nymph. The epiproct is set halfway back on the tenth tergum with a broad membranous anterior area (figs. 370, 371). The female subgenital plate is very broad and greatly produced; rounded and entire along the posterior margin (fig. 372). The cerci of the nymphs are distinctly black-tipped, a character shared only with the genus *Perlinodes* in the Rocky Mountains.

Pictetiella expansa (Banks) (figs. 50, 51, 370-372)

Perla expansa Banks, 1920, 64: 317.
Perla expansa, Needham and Claassen, 1925, 2: 81, female; fig. 4, p. 325, female genitalia.

Isogenus (Pictetia) expansus, Ricker, 1952, 18: 121, male and nymph; fig. 74, p. 121, male genitalia.
Pictetiella expansella, Illies, 1966, 82: 375.
Pictetiella expansa, Baumann, 1973, 33: 97, male, nymph and egg: fig. 11, p. 98, nymph; figs. 12e-12h, p. 100, egg.

Type locality. — Grant, Colorado.

Geographic range. — Rocky Mts.

Distribution in Rocky Mts. — (Northern, Central and Southern Rockies): COLORADO: Gilpin Co.; Larimer Co. IDAHO: Bonneville Co.; Shoshone Co.; Teton Co. MONTANA: Gallatin Co.; Glacier Co. UTAH: Salt Lake Co.; Utah Co. WYOMING: Teton Co.

Discussion. — This species is uncommon but quite distinctive in the adult and mature nymphal stages. The adults emerge from July through October.

Genus SETVENA Ricker 1952

Setvena is a peculiar genus that is unique in bearing short submental gills and two pairs of thoracic gills or gill remnants. The transverse ridge of the mesosternal ridge pattern is lacking in the adult, but strongly developed and sinuate in the nymph. The epiproct is slender, nearly cylindrical, blunt and sclerotized on the posterior surface (fig. 409). The lateral stylets are slender, pointed and spinulous at the apex (fig. 410). The epiproct is strongly produced and broadly rounded (fig. 408). Nymphs of this species are stout bodied and look much like very large specimens of the genus *Isoperla*.

Setvena bradleyi (Smith) (figs. 408-410)

Protarcys bradleyi Smith, 1917, 43: 470, male and female; figs. 40-42, pl. 33, male and female genitalia.
Perlodes bradleyi, Needham and Claassen, 1925, 2: 53.
Perlodes tibialis, Frison (not *tibialis* Banks, 1914), 1942, 22: 289.
Protarcys bradleyi, Hanson, 1942, 28: 402.
Arcynopteryx (Setvena) bradleyi, Ricker, 1952, 18: 82.
Setvena bradleyi, Illies, 1966, 82: 377.

Type locality. — Lake Louise, Alberta.

Geographic range. — Rocky Mts.

Distribution in Rocky Mts. — (Canadian and Northern Rockies): ALBERTA: Banff N. P. BRITISH COLUMBIA: Kaslo; Selkirk Mts. IDAHO: Fremont Co.; Lemhi Co.; Shoshone Co. MONTANA: Flathead Co.; Glacier Co.; Missoula Co.; Powell Co.; Ravalli Co.

Discussion. — This rare species is found in creeks and springs. The adults emerge from June to August.

Genus SKWALA Ricker 1952

The genus *Skwala* consists of medium-sized, dark brown stoneflies lacking all but submental gills or gill remnants. The arms of the Y-ridge join the anterior corners of the furcal pits as in *Megarcys* and *Arcynopteryx*. The tenth tergum of the male is cleft, with long, subcylindrical, spinulose lobes, pointing inward and forward (fig. 411). The epiproct is subcylindrical near the tip, with two flaps rolled inward at each side. The subgenital plate is briefly produced and rounded or slightly excavated (fig. 412). The major spine of the nymphal maxillae is about half as long as the entire lacinia. Two species are recorded from the Rocky Mountain area, *S. curvata* and *S. parallela*.

Key to the Species of Skwala

Males

1. Dorsal lobes of tenth tergum two to three times as long as width of constricted portion (fig. 411) .... *parallela*
   Dorsal lobes of tenth tergum four to five times as long as width of constricted portion (fig. 414) .... *curvata*

Females

1. Subgenital plate truncated on lateral corners and slightly excavated medially, thus appearing angular; plate flat and sclerotized continuously with rest of sternum (fig. 412) .... *parallela*
   Subgenital plate rounded on lateral corners, excavated medially, not appearing angular; plate swollen, especially along excavated margin, with membranous area along excavated margin near posterior border (fig. 415) .... *curvata*

Skwala curvata (Hanson) (figs. 413-415)

Arcynopteryx curvata Hanson, 1942, 28: 395, male and female; fig. 13, p. 405, female genitalia; fig. 22, p. 406, male genitalia.
Arcynopteryx (*Skwala*) *parallela curvata,* Ricker, 1943, 12: 114.
Skwala curvata, Illies, 1966, 82: 378.

Type locality. — Wallace, Idaho.

Geographic range. — Coast, Cascade and Rocky Mts.

Distribution in Rocky Mts. — (Canadian, Northern and Central Rockies): BRITISH COLUMBIA: Penticton. IDAHO: Latah Co.; Lemhi Co.; Bonner Co. MONTANA: Beaverhead Co.; Flathead Co.; Gallatin Co.; Granite Co.; Lake Co.; Lewis and Clark Co.; Lincoln Co.; Mineral Co.; Missoula Co.; Powell Co. WYOMING: Park Co.

Discussion. — This species is common in creeks but is found in colder streams than *Skwala parallela* (Frison). The adults emerge from February to May.

Skwala parallela (Frison) (figs. 39, 52, 411, 412)

Perlodes americana, Needham and Claassen (not Klapalek, 1912), 1925, 2: 61, male and female; fig. 21, p. 305, female genitalia; fig. 5, p. 311, male genital hook.
Hydroperla parallela Frison, 1936, 29: 261.
Hydroperla parallela Frison, 1942b, 22: 298, nymph; fig. 70, p. 298, nymph.
Arcynopteryx americana, Hanson, 1942, 28: 394.
Arcynopteryx (*Skwala*) *parallela parallela*, Ricker, 1943, 12: 113.
Skwala parallela, Illies, 1966, 82: 378.

Type locality. — Corvallis, Oregon.

Geographic range. — Coast, Cascade, Rocky and Sierra Nevada Mts.

Distribution in Rocky Mts. — (Canadian, Northern, Central and Southern Rockies): BRITISH COLUMBIA: Keremeos; Oliver. ARIZONA: Apache Co.; Gila Co.; Graham Co. COLORADO: Archuleta Co.; Boulder Co.; Conejos Co.; Gunnison Co.; Hinsdale Co.; La Plata Co.; Larimer Co.; Montezuma Co.; Montrose Co.; Ouray Co.; Routt Co.; Saguache Co. IDAHO: Bannock Co.; Blaine Co.; Bonneville Co.; Butte Co.; Caribou Co.; Clark Co.; Custer Co.; Franklin Co.; Fremont Co.; Latah Co.; Lemhi Co.; Nez Perce Co. MONTANA: Broadwater Co.; Cascade Co.; Flathead Co.; Gallatin Co.; Granite Co.; Jefferson Co.; Madison Co.; Mineral Co.; Missoula Co.; Park Co.; Powell Co.; Ravalli Co.; Stillwater Co.; Sweet Grass Co. NEVADA: Elko Co. NEW MEXICO: Eddy Co.; Taos Co. OREGON: Baker Co. UTAH: Box Elder Co.; Cache Co.; Daggett Co.; Davis Co.; Emery Co.; Millard Co.; Morgan Co.; Salt Lake Co.; San Juan Co.; Sanpete Co.; Summit Co.; Utah Co.; Wasatch Co.; Washington Co.; Weber Co. WYOMING; Albany Co.; Carbon Co.

Discussion. — This species is common in creeks and rivers throughout its range. The adults emerge from February through July.

Subfamily Isoperlinae

Genus ISOPERLA Banks 1906

The two subfamilies of Perlodidae are often difficult to separate, except on the basis of male genitalia. Isoperlinae exhibits a loss of the epiproct and the lobe on the seventh sternum, a retention of the lobe on the eighth sternum, and a modification of the subanal lobes into hooks (figs. 417, 419). Gills and gill remnants are always lacking in the Isoperlinae, but are retained as simple filaments in some representatives of the Perlodinae. A transverse ridge and posterior junction of the Y-ridges to the furcal pits characterize the typical mesosternal ridge pattern of adults and immatures (figs. 24, 25). Adults of the subfamily are yellow or brown colored and generally smaller than their Perlodinae counter-

parts. Nymphs are often brightly striped in brown and yellow. Nymphal abdominal color patterns, adult genitalia and setal patterns are used to differentiate species. *Isoperla* is the only genus of Isoperlinae recorded from the Rocky Mountains.

Key to the Species of Isoperla

Males

1. Crossveins present in the branches of the radial sector (fig. 446); pronotum checkered black on yellow .... *phalerata*
   Crossveins absent from the branches of the radial sector (figs. 48, 49); color pattern on pronotum variable 2
2. Median and lateral ocelli connected by dark line forming "V" .... *bilineata*
   Median and lateral ocelli not connected by dark line 3
3. Tip of tergum ten with two small recurved processes (figs. 440, 441); eighth sternum lacking lobe (fig. 442); complete median dark stripe on head, darkest between ocelli; broad median and lateral stripes on pronotum .... *trictura*
   Tip of tergum ten without processes (figs. 437, 438); eighth sternum with lobe; color of head and pronotum not as above 4
4. Cerci about twice as long as relaxed abdomen, length of segment twelve, six to eight times greatest width (fig. 445); two conspicuous spinule patches on tergum nine (fig. 431) .... *longiseta*
   Cerci less than one and one half times as long as relaxed abdomen, length of segment twelve, three to five times its greatest width; usually no spinules on tergum nine 5
5. Lobe on sternum eight nearly square; tergum nine bearing spinules (figs. 437, 438) .... *mormona*
   Lobe on sternum eight broadly rounded; tergum nine lacking spinules (but with short stout hairs in *patricia*) 6
6. Pronotum checkered, black on yellow; subanal lobes flat, recurved, chisel-shaped, bent outward near tips (figs. 422, 423) .... *pinta*
   Pronotum striped or reticulately marked; subanal lobes not bent outward close to tips (figs. 427, 428) 7
7. Ocellar area dark or with only a light spot, never totally light 8
   Ocellar area totally light in color 9
8. Less than 10 mm in length; each arm of bifurcate aedeagal spine bearing tooth on lower margin (fig. 430); subanal lobes short (figs. 427, 428) .... *fusca*
   Ten to 11 mm in length; each arm of aedeagal spine thick, lacking tooth (fig. 420); subanal lobes long, thin, acutely bent upward (fig. 421) .... *sordida*

FIGURES 391-397. — *Kogotus modestus* (Banks): 391, female terminalia, ventral view; 392, male terminalia, lateral view; 393, male terminalia, dorsal view. *Kogotus nonus* (Needham and Claassen): 394, male terminalia, dorsal view; 395, male terminalia, lateral view. *Diura knowltoni* (Frison): 396, male terminalia, dorsal view; 397, female terminalia, ventral view.

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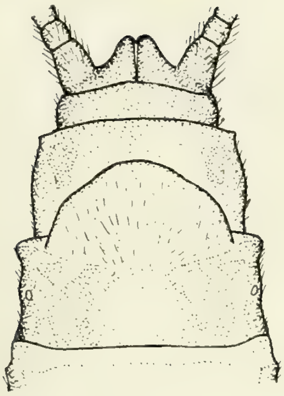

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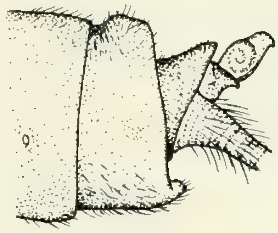

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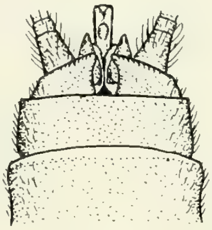

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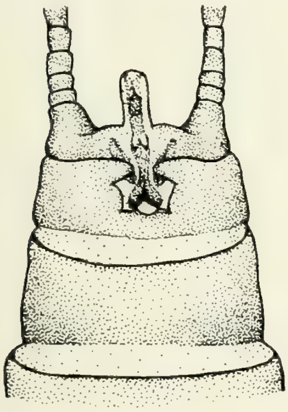

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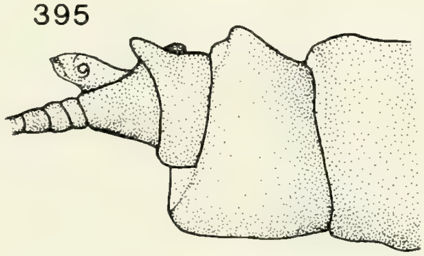

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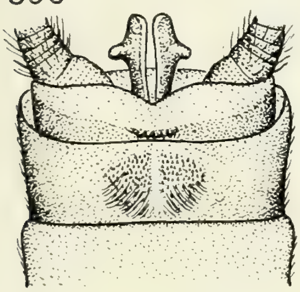

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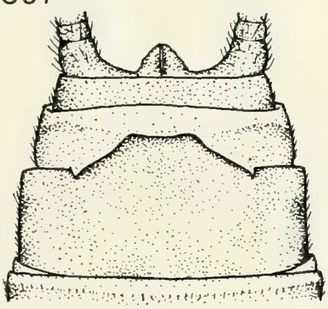

9. Patches of short stout hairs on posterior margin of tergum nine (figs. 432, 433); often a red cast to terminal abdominal segments .... *patricia*
No patches of stout hairs on tergum nine (fig. 426); seldom red cast to abdominal segments 10
10. Lobe on sternum eight indistinct .... *ebria*
Lobe on sternum eight distinct 11
11. Wings brachypterous; aedeagus with a slender sharp spine, forked at the base (fig. 418) .... *petersoni*
Wings normal; aedeagus without a slender sharp spine 12
12. Ninth sternum evenly rounded behind (figs. 424, 425) .... *fulva*
Ninth sternum truncate behind (fig. 416) .... *quinquepunctata*

Females

1. Crossveins present in the branches of the radial sector (fig. 446); pronotum checkered black on yellow .... *phalerata*
Crossveins absent from the branches of the radial sector; pronotal color pattern variable (figs. 48, 49) 2
2. Median and lateral ocelli connected by dark line forming "V" .... *bilineata*
Median and lateral ocelli not connected by dark line 3
3. Eighth sternum not produced except for small median process (fig. 443); complete median dark stripe on head, darkest between ocelli; broad median and lateral light stripes on pronotum .... *trictura*
Eighth sternum not as above (fig. 453); color of head and pronotum not as above 4
4. Cerci about twice as long as relaxed abdomen, length of segment twelve, six to eight times greatest width (fig. 445); subgenital plate somewhat produced and rounded, truncate or slightly excavated (fig. 453) .... *longiseta*
Cerci less than one and one half times as long as relaxed abdomen, length of segment twelve, three to five times its greatest width; subgenital plate variable 5
5. Subgenital plate little produced (fig. 439); small yellow species (11 mm or less) .... *mormona*
Subgenital plate variable; medium to large species (11 mm or more) 6
6. Pronotum checkered black on yellow; subgenital plate moderately produced, with slight median excavation (fig. 452) .... *pinta*
Pronotum striped or reticulately marked; subgenital plate variable 7
7. Ocellar area with small light spot, never totally light 8
Ocellar area totally light in color 9
8. Body length less than 11 mm .... *fusca*
Body length 11 to 12 mm .... *sordida*
9. Subgenital plate with wide, deep excavation (fig. 450); often with red cast to terminal abdominal segments .... *patricia*
Subgenital plate without wide, deep excavation; seldom with red cast to abdominal segments 10

FIGURES 398-407. — *Perlinodes aurea* (Smith): 398, male terminalia, lateral view; 399, female terminalia, ventral view. *Megarcys watertoni* (Ricker): 400, male

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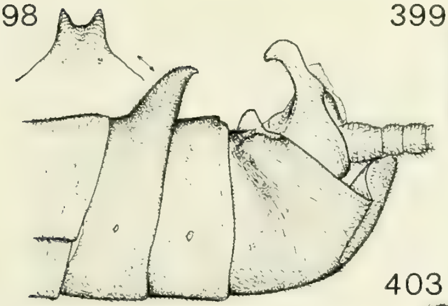

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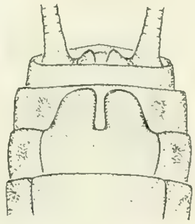

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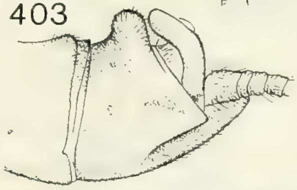

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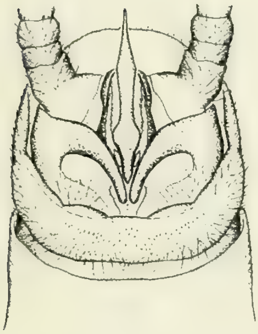

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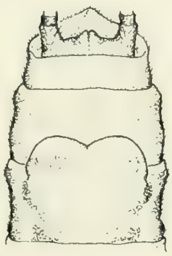

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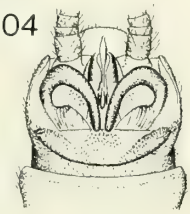

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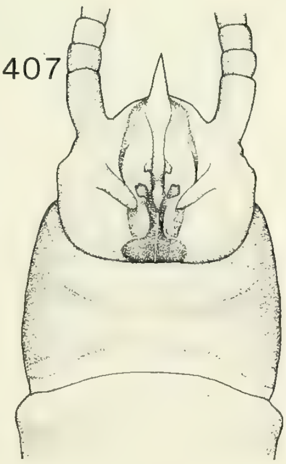

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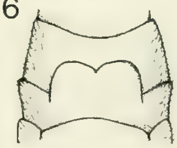

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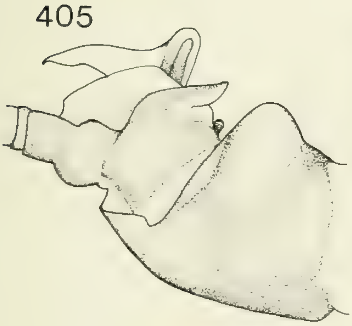

terminalia, dorsal view; 401, female terminalia, ventral view. *Megarcys signata* (Hagen): 402, female terminalia, ventral view; 403, male terminalia, lateral view; 404, male terminalia, dorsal view. *Megarcys subtruncata* (Hanson): 405, male terminalia, lateral view; 406, female terminalia, ventral view; 407, male terminalia, dorsal view.

10. Subgenital plate at least as long as sternum seven, its sides nearly parallel at base (figs. 447, 454) 11
Subgenital plate shorter than sternum seven, its sides rounded (figs. 448, 451) 12
11. Subgenital plate semicircular in outline, lacking emargination (fig. 447) .... *ebria*
Subgenital plate truncate in outline with slight median emargination (fig. 454) .... *quinquepunctata*
12. Subgenital plate thickened and bent downward near tip (fig. 448); head pattern interrupted at transverse occipital suture .... *fulva*
Subgenital plate flat, thickened and slightly emarginate at tip, but not sharply bent downward (fig. 451); head pattern continuous across occipital suture .... *petersoni*

Nymphs

(*phalerata, trictura* and *sordida* unknown)

1. Light areas on head between compound eyes and adjacent to ocelli usually forming large detached spots; three longitudinal dark stripes on dorsum of abdomen indistinct; inner margin of lacinia lined with row of long stiff setae .... *bilineata*
Color pattern and lacinia otherwise 2
2. Ocellar area totally dark; broad pale yellow longitudinal stripe in middle of pronotum .... *fusca*
Color pattern distinctly different 3
3. Head, thorax, and abdomen with distinct checkered pattern .... *pinta*
Head, thorax, and abdomen without checkered pattern 4
4. Paired dorsal yellow spots on each abdominal tergum .... *ebria*
Longitudinal striped pattern on abdominal terga 5
5. Abdominal terga with broad median longitudinal yellow band bordered on each side by dark band 6
Abdominal terga with narrow median dark band bordered on each side by broader light band 8
6. Mature nymphs never over 9 mm long; legs without fringe of long white hairs .... *petersoni*
Mature nymphs 12 to 13 mm long; legs with fringe of long white hairs 7
7. Occipital row of spinules present; light area on head around each eye but without an irregular light spot between eyes .... *fulva*
No occipital row of spinules; no light area on head around eyes but with an irregular light spot between eyes .... *quinquepunctata*
8. Cerci about twice as long as relaxed abdomen .... *longiseta*
Cerci less than one and one half times as long as relaxed abdomen 9
9. Mature nymph never over 10 mm long .... *mormona*
Mature nymph 12 to 13 mm long .... *patricia*

FIGURES 408-415. — *Setvena bradleyi* (Smith): 408, female terminalia, ventral view; 409, male terminalia, dorsal view; 410, lateral stylets. *Skwala parallela* (Frison): 411, male terminalia, dorsal view; 412, female terminalia, ventral view. *Skwala curvata* (Hanson): 413, male terminalia, lateral view; 414, male terminalia, dorsal view; 415, female terminalia, ventral view.

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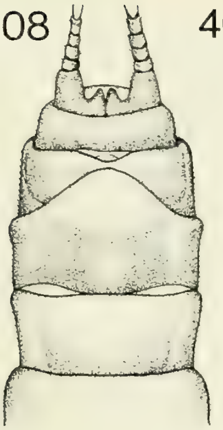

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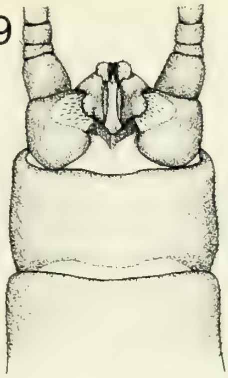

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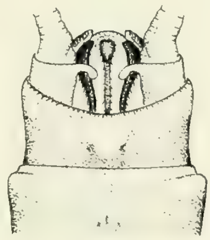

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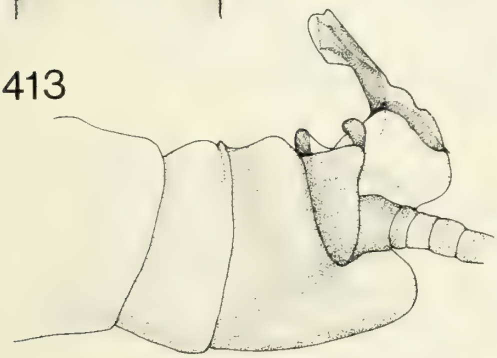

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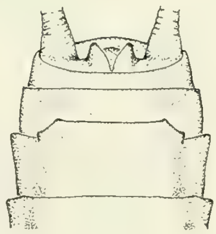

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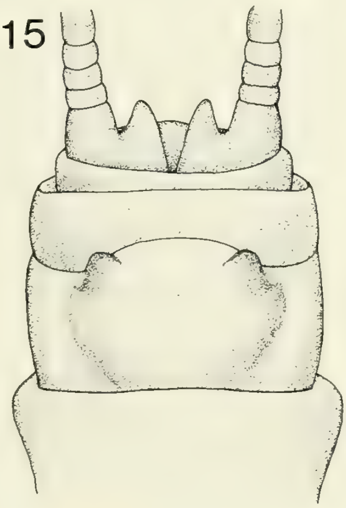


Isoperla bilineata (Say) (figs. 434-436)

Sialis bilineata Say, 1823, 2: 165.
Chloroperla bilineata, Newman, 1839, 3: 87.
Perla bilineata, Pictet, 1841, 1: 283.
Isoperla bilineata, Needham and Claassen, 1925, 2: 154, male and female; figs. 12-13, p. 301, egg; figs. 9-10, 12, p. 343.
Isoperla bilineata, Frison, 1935, 20: 437, nymph; fig. 335, p. 436, nymph.

Type locality. — Ohio River, Cincinnati, Ohio.

Geographic range. — Eastern and Central North America.

Distribution in Rocky Mts. — (Southern Rockies): COLORADO: No locality.

Discussion. — This species is very common in the eastern and midwestern United States, especially in larger rivers. Although no locality for Colorado is listed in Needham and Claassen (1925) it is likely that it occurred in the larger rivers of eastern Colorado before these rivers were drastically changed by diversion and pollution.

Isoperla ebria (Hagen) (figs. 426, 444, 447)

Perla ebria Hagen, 1875, 7: 577.
Clioperla ebria, Needham and Claassen, 1925, 2: 141, male and female; figs. 1-3, p. 351, male and female genitalia.
Clioperla ebria, Claassen, 1931, 3: 71, nymph.
Isoperla ebria, Ricker, 1943, 12: 121, nymph; fig. 107, p. 123, nymph.

Type locality. — Colorado.

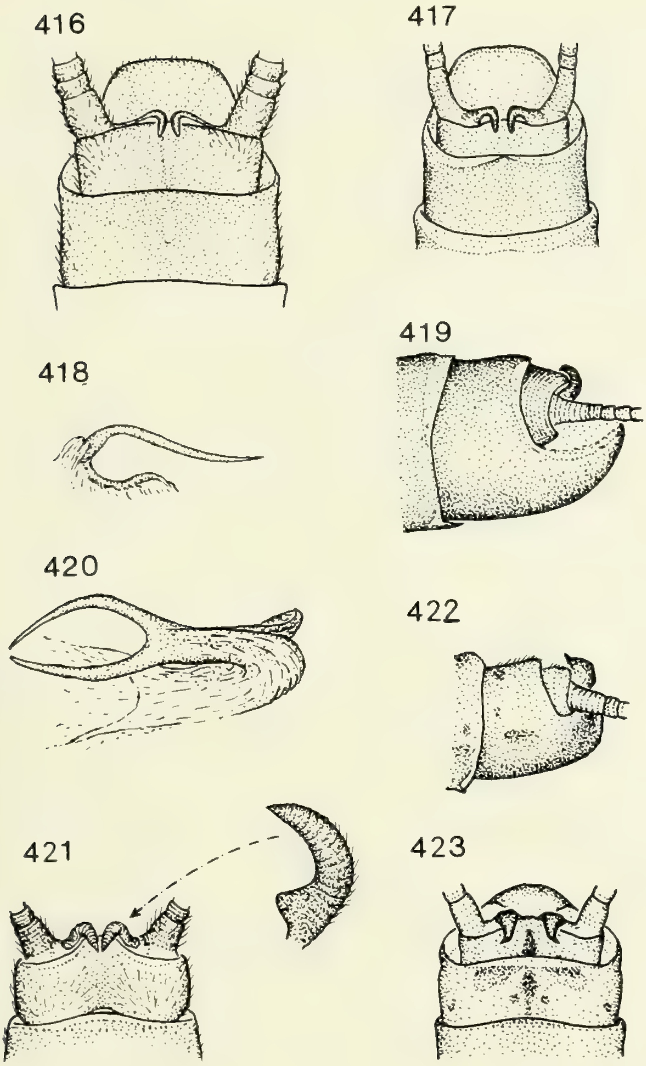
Geographic range. — Coast, Cascade, Rocky and Sierra Nevada Mts.

Distribution in Rocky Mts. — (Canadian, Northern, Central and Southern Rockies): ALBERTA: Banff N. P. BRITISH COLUMBIA: Penticton; Quesnel; Mt. Revelstoke; Summit Lake. COLORADO: Boulder Co.; Custer Co.; Gilpin Co.; Summit Co. IDAHO: Latah Co. MONTANA: Flathead Co.; Gallatin Co.; Glacier Co.; Granite Co.; Lake Co.; Missoula Co.; Pondera Co.; Powell Co.; Ravalli Co.; Sweet Grass Co. NEW MEXICO: Santa Fe Co.; Taos Co. OREGON: Union Co. UTAH: Daggett Co.; Duchesne Co.; Garfield Co.; Iron Co.; Salt Lake Co.; Wasatch Co.; Washington Co. WYOMING: Albany Co.; Park Co.; Sublette Co.

Discussion. — This species occurs commonly in creeks and rivers. The adults emerge from May through July.

Isoperla fulva Claassen (figs. 24, 41, 48, 49, 424, 425, 448)

Isoperla fulva Claassen, 1937a, 69: 80, male and female; figs. 9, 12, 15, p. 78, male and female genitalia.



FIGURES 416-423. — 416, *Isoperla quinquepunctata* (Banks), male terminalia, dorsal view. *Isoperla petersoni* Needham and Christensen; 417, male terminalia, dorsal view; 418, spine on aedeagus; 419, male terminalia, lateral view. *Isoperla sordida* (Banks): 420, spine on aedeagus; 421, male terminalia, dorsal view. *Isoperla pinta* (Frison): 422, male terminalia, lateral view; 423, male terminalia, dorsal view.

Isoperla chrysannula Hoppe, 1938, 4: 156.
Isoperla cascadensis Hoppe, 1938, 4: 158.

Type locality. — Logan River, Cache Co., Utah.

Geographic range. — Coast, Cascade, Rocky and Sierra Nevada Mts.

Distribution in Rocky Mts. — (Canadian, Northern, Central and Southern Rockies): BRITISH COLUMBIA: Cranbrook; Creston; Kootenay N. P.; Likely; Oliver; Quesnel; Summerland; Wells Gray P. P. ARIZONA: Apache Co. COLRADO: Chaffee Co.; Clear Creek Co.; Delta Co.; Eagle Co.; Grand Co.; Gunnison Co.; Hinsdale Co.; La Plata Co.; Larimer Co.; Mesa Co.; Montrose Co.; Routt Co.; Saguache Co.; Summit Co. IDAHO: Bannock Co.; Bear Lake Co.; Boise Co.; Bonner Co.; Bonneville Co.; Butte Co.; Caribou Co.; Clark Co.; Custer Co.; Franklin Co.; Fremont Co.; Idaho Co.; Lemhi Co.; Nez Perce Co.; Owyhee Co.; Teton Co.; Valley Co. MONTANA: Beaverhead Co.; Broadwater Co.; Carbon Co.; Cascade Co.; Fergus Co.; Flathead Co.; Gallatin Co.; Glacier Co.; Granite Co.; Judith Basin Co.; Lake Co.; Lewis and Clark Co.; Madison Co.; Meagher Co.; Missoula Co.; Park Co.; Powell Co.; Ravalli Co;. Stillwater Co.; Sweet Grass Co. NEVADA: Elko Co. NEW MEXICO: San Miguel Co.; Santa Fe Co.; Taos Co. UTAH: Beaver Co.; Box Elder Co.; Cache Co.; Duchesne Co.; Garfield Co.; Millard Co.; Salt Lake Co.; Sanpete Co.; Sevier Co.; Summit Co.; Tooele Co.; Uintah Co.; Utah Co.; Wasatch Co.; Weber Co.; WASHINGTON: Columbia Co. WYOMING: Albany Co.; Carbon Co.; Lincoln Co.; Park Co.; Platte Co.; Sublette Co.; Teton Co.; Washakie Co.

Discussion. — This species is common in creeks and rivers throughout its range. The adults emerge from April to August.

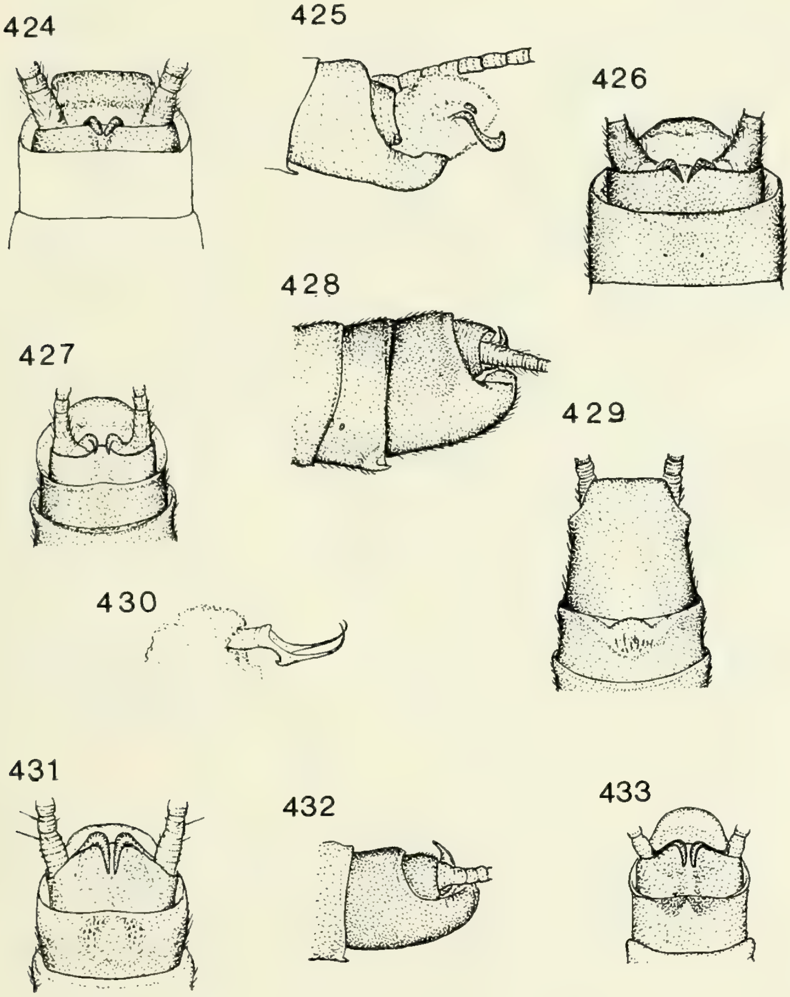
Isoperla fusca Needham and Claassen (figs. 427-430, 449)

Isoperla fusca Needham and Claassen, 1925, 2: 146, male and female; figs. 4-6, p. 343, male and female genitalia.
Isoperla fusca, Frison, 1942b, 22: 317, nymph; fig. 92, nymph.

Type locality. — Waterton Lakes N. P., Alberta.

Geographic range. — Coast, Cascade and Rocky Mts.

Distribution in Rocky Mts. — (Canadian, Northern and Central Rockies): ALBERTA: Banff N. P.; Waterton Lakes N. P. IDAHO: Bannock Co.; Blaine Co.; Bonneville Co.; Fremont Co.; Idaho Co.; Latah Co.; Lemhi Co.; Valley Co. MONTANA: Carbon Co.; Flathead Co.; Gallatin Co.; Glacier Co.; Lake Co.; Madison Co.; Meagher Co.; Missoula Co.; Pondera Co.; Powell Co.; Ravalli Co.; Silver Bow Co. WYOMING: Park Co.; Teton Co.



FIGURES 424-433. — *Isoperla fulva* Claassen: 424, male terminalia, dorsal view; 425, male terminalia, lateral view; 426, *Isoperla ebria* (Hagen), male terminalia, dorsal view. *Isoperla fusca* Needham and Claassen: 427, male terminalia, dorsal view. 428, male terminalia, lateral view; 429, male terminalia, ventral view; 430, spine on aedeagus. 431, *Isoperla longiseta* Banks, male terminalia, dorsal view. *Isoperla patricia* Frison: 432, male terminalia, lateral view; 433, male terminalia, dorsal view.

Discussion. — This species is common in creeks. The adults emerge from May to August.

Isoperla longiseta Banks (figs. 431, 445, 453)

Isoperla longiseta Banks, 1906a, 38: 337.

Isoperla longiseta, Needham and Claassen, 1925, 2: 156, male and female; figs. 15-17, p. 342, male and female genitalia.

Type locality. — Onaga, Kansas.

Geographic range. — Great Plains to Rocky Mts.

Distribution in Rocky Mts. — (Canadian, Northern, Central and Southern Rockies): BRITISH COLUMBIA: Oliver; Prince George. COLORADO: Archuleta Co.; Grand Co.; Huerfano Co.; Moffat Co. IDAHO: Ricker (1964) lists this species from Upper Snake River in S. E. Idaho. MONTANA: Blaine Co.; Carbon Co.; Chouteau Co.; Dawson Co.; Glacier Co.; Roosevelt Co.; Stillwater Co.; Yellowstone Co. NEW MEXICO: Rio Arriba Co. UTAH: Daggett Co.; Grand Co.; Kane Co.; Uintah Co. WYOMING: Goshen Co.; Niobrara Co.; Platte Co.; Sheridan Co.; Sweetwater Co.

Discussion. — This species is restricted to large rivers. The adults emerge from May to mid-July.

Isoperla mormona Banks (figs. 25, 437-439, 456)

Isoperla mormona Banks, 1920, 64: 322.

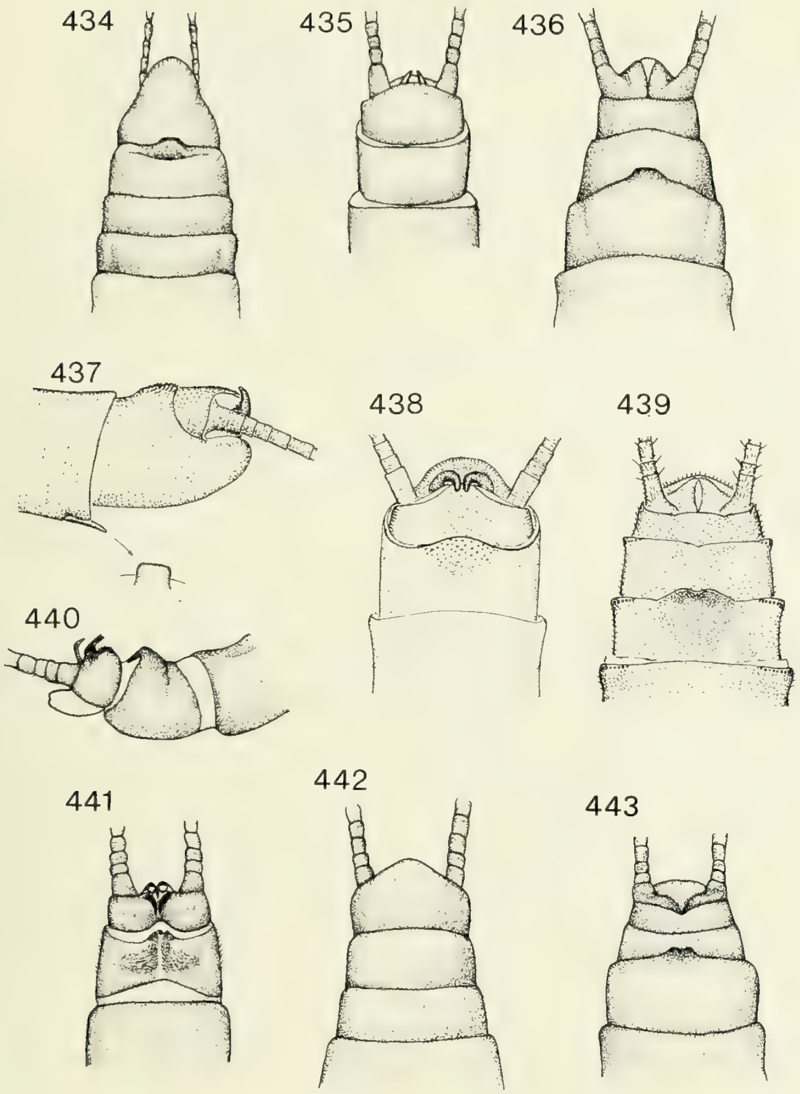
Isoperla mormona, Needham and Claassen, 1925, 2: 153, male and female; figs. 1-3, p. 354, male and female genitalia.

Isoperla insipida Hoppe, 1938, 4: 157.

Type locality. — Vinyard, Utah.

Geographic range. — Coast, Cascade, Rocky and Sierra Nevada Mts.

Distribution in Rocky Mts. — (Canadian, Northern, Central and Southern Rockies): BRITISH COLUMBIA: Oliver; Vernon. ARIZONA: Apache Co.; Navajo Co. COLORADO: Archuleta Co.; Delta Co.; Gunnison Co.; La Plata Co.; Rio Blanco Co. IDAHO: Bannock Co.; Bingham Co.; Bonneville Co.; Butte Co.; Cassia Co.; Clark Co.; Fremont Co.; Gooding Co.; Lemhi Co.; Power Co.; Shoshone Co.; Twin Falls Co. MONTANA: Beaverhead Co.; Broadwater Co.; Cascade Co.; Fergus Co.; Gallatin Co.; Granite Co.; Jefferson Co.; Lake Co.; Madison Co.; Pondera Co.; Ravalli Co.; Stillwater Co.; Sweet Grass Co. NEW MEXICO: Catron Co.; Grant Co.; Lincoln Co.; Mora Co.; Otero Co.; San Miguel Co. UTAH: Beaver Co.; Daggett Co.; Davis Co.; Sevier Co.; Utah Co.; Wasatch Co.; Wayne Co.; Weber Co. WYOMING: Johnson Co.; Lincoln Co.; Park Co.; Sublette Co.; Sweetwater Co.; Teton Co.; Uinta Co.



FIGURES 434-443. — *Isoperla bilineata* (Say): 434, male terminalia, ventral view; 435, male terminalia, dorsal view; 436, female terminalia, ventral view. *Isoperla mormona* (Banks): 437, male terminalia, lateral view; 438, male terminalia, dorsal view; 439, female terminalia, ventral view. *Isoperla trictura* (Hoppe): 440, male terminalia, lateral view; 441, male terminalia, dorsal view; 442, male terminalia, ventral view; 443, female terminalia, ventral view.

Discussion. — This species is commonly found in creeks and rivers. The adults emerge from May to August.

Isoperla patricia Frison (figs. 42, 432, 433, 450)

Isoperla patricia Frison, 1942b, 22: 313, male, female and nymph; fig. 87, p. 313, male and female genitalia; fig. 89, p. 315, nymph.

Type locality. — Spearfish, South Dakota.

Geographic range. — Coast, Cascade, Rocky and Sierra Nevada Mts.

Distribution in Rocky Mts. — (Canadian, Northern, Central and Southern Rockies): BRITISH COLUMBIA: Prince George. ARIZONA: Coconino Co. COLORADO: Alamosa Co.; Arapahoe Co.; Archuleta Co.; Boulder Co.; Chaffee Co.; Delta Co.; Douglas Co.; Eagle Co.; Fremont Co.; Garfield Co.; Grand Co.; Gunnison Co.; Hinsdale Co.; Larimer Co.; Mesa Co.; Moffat Co.; Montezuma Co.; Montrose Co.; Ouray Co.; Park Co.; Rio Blanco Co.; Routt Co.; Saguache Co. IDAHO: Ada Co.; Bear Lake Co.; Bingham Co.; Blaine Co.; Boise Co.; Bonneville Co.; Butte Co.; Caribou Co.; Cassia Co.; Custer Co.; Franklin Co.; Fremont Co.; Jefferson Co.; Lemhi Co.; Teton Co. MONTANA: Beaverhead Co.; Big Horn Co.; Broadwater Co.; Carbon Co.; Cascade Co.; Fergus Co.; Flathead Co.; Gallatin Co.; Glacier Co.; Granite Co.; Judith Basin Co.; Lake Co.; Lincoln Co.; Madison Co.; Meagher Co.; Missoula Co.; Park Co.; Ravalli Co.; Sweet Grass Co.; Stillwater Co.; Wheatland Co.; Yellowstone Co. NEVADA: Elko Co.; Lincoln Co.; Humboldt Co.; White Pine Co. NEW MEXICO: Colfax Co.; Taos Co.; Valencia Co. OREGON: Grant Co. SOUTH DAKOTA: Custer Co.; Lawrence Co. UTAH: Cache Co.; Daggett Co.; Duchesne Co.; Iron Co.; Millard Co.; Salt Lake Co.; Sevier Co.; Summit Co.; Tooele Co.; Uintah Co.; Utah Co.; Wasatch Co.; Weber Co. WYOMING: Albany Co.; Carbon Co.; Johnson Co.; Lincoln Co.; Park Co.; Platte Co.; Sheridan Co.; Sublette Co.; Teton Co.; Uinta Co.

Discussion. — This species is abundant in both creeks and rivers. The adults emerge from April through August.

Isoperla petersoni Needham and Christenson (figs. 417-419, 451)

Isoperla petersoni Needham and Christenson, 1927, 201: 19, adult and nymph; figs. 24-25, p. 19, male and nymph.

FIGURES 444-455. — 444, *Isoperla ebria* (Hagen), head and pronotum; 445, *Isoperla longiseta* Banks, cercal segment; 446, *Isoperla phalarata* (Smith), wings; 447, *Isoperla ebria* (Hagen), female terminalia, ventral view; 448, *Isoperla fulva* Claassen, female terminalia, ventral view; 449, *Isoperla fusca* Needham and Claassen, female terminalia, ventral view; 450, *Isoperla patricia* Frison, female terminalia, ventral

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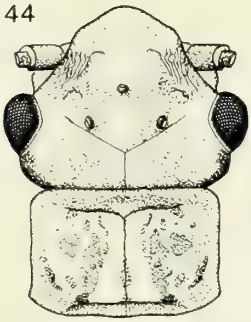

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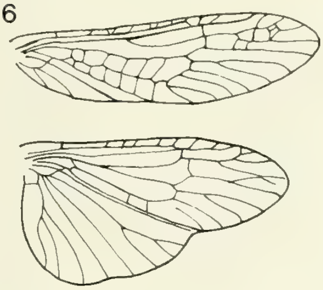

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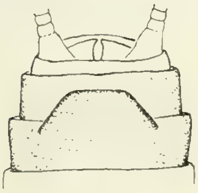

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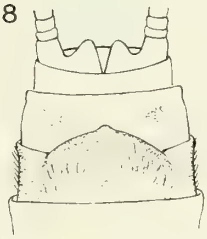

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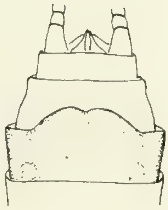

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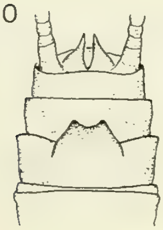

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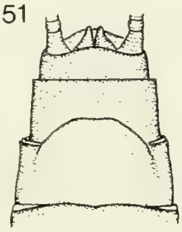

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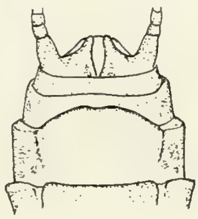

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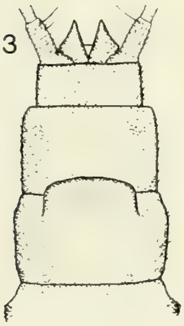

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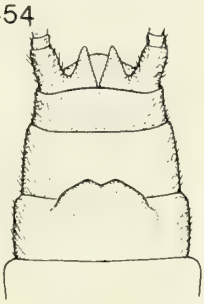

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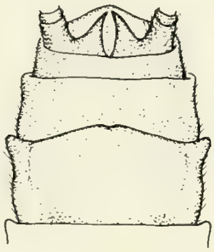


view; 451, *Isoperla petersoni* Needham and Christensen, female terminalia, ventral view; 452, *Isoperla pinta* Frison, female terminalia, ventral view; 453, *Isoperla longiseta* Banks, female terminalia, ventral view; 454, *Isoperla quinquepunctata* (Banks), female terminalia, ventral view; 455, *Isoperla sordida* (Banks), female terminalia, ventral view.

Isoperla frontium Neave, 1929, 4: 161.
Isoperla petersoni, Claassen, 1937a, 69: 81, male and female; figs. 11, 13-14, p. 78, male and female genitalia.

Type locality. — Petersons Spring, Logan Canyon, Utah.

Geographic range. — Alaska and Rocky Mts.

Distribution in Rocky Mts. — (Northern and Southern Rockies): ALBERTA: Banff N. P. BRITISH COLUMBIA: Glacier N. P.; Oliver; Prince George; Selkirk Mts.; Summit Lake. IDAHO: Bannock Co.; Fremont Co. MONTANA: Gallatin Co.; Glacier Co. UTAH: Cache Co.; Emery Co.; Wasatch Co. WYOMING: Teton Co.

Discussion. — This rare species has been collected in springs and spring-fed creeks. The adults emerge from late May to November.

Isoperla phalerata (Smith) (fig. 446)

Dictyogenus phaleratus Smith, 1917, 43: 485, female; fig. 56, pl. 33, female genitalia.
Isogenus phaleratus, Ricker, 1952, 18: 131; figs. 82-85, p. 130, head, wings, female genitalia.
Isoperla phalerata, Jewett, 1954, 11: 548, male; fig. 10, p. 544, male genitalia.

Type locality. — New Mexico.

Geographic range. — Coast, Cascade and Rocky Mts.

Distribution in Rocky Mts. — (Central and Southern Rockies): COLORADO: Grand Co. IDAHO: Bannock Co.; Blaine Co. NEW MEXICO: San Miguel Co. SOUTH DAKOTA: Custer Co.; Lawrence Co. WYOMING: Albany Co.

Discussion. — This rare species occurs in creeks and rivers. The adults emerge from April to August.

Isoperla pinta Frison (figs. 422, 423, 452)

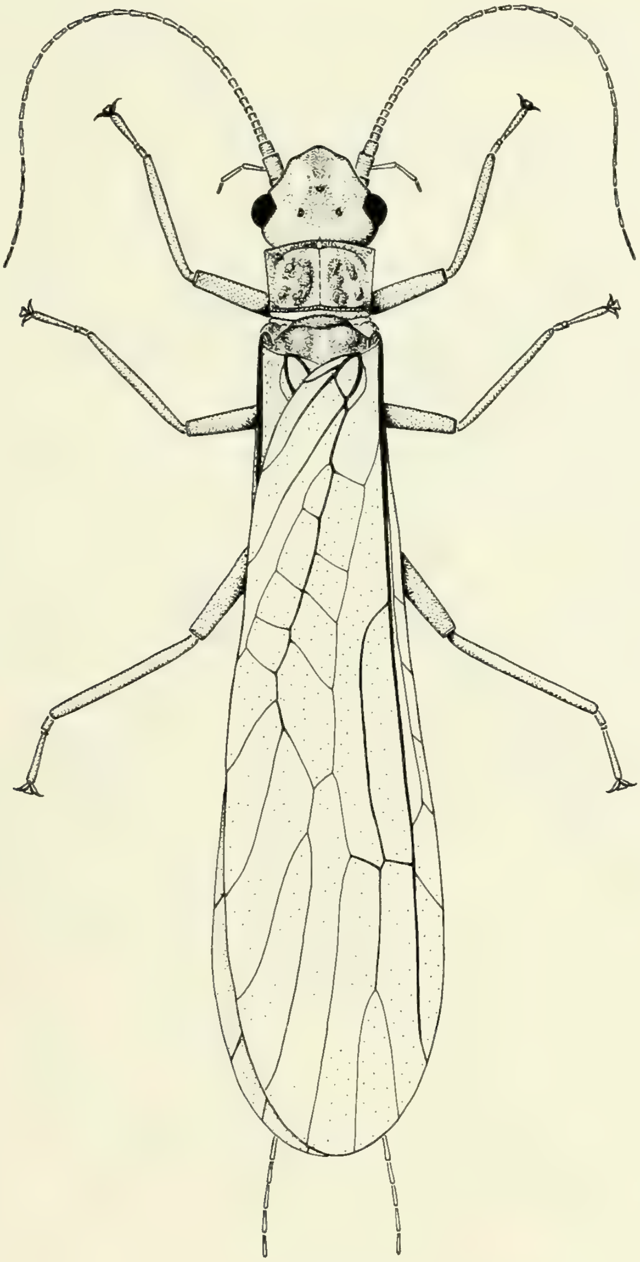
Isoperla pinta Frison, 1937, 21: 92, male, female and nymph; figs. 81-82, p. 309, male and female genitalia and nymph.

Type locality. — Curry Co., Oregon.

Geographic range. — Coast, Cascade and Rocky Mts.

Distribution in Rocky Mts. — (Northern, Central and Southern Rockies): COLORADO: Grand Co.; Gunnison Co.; Routt Co.; Saguache Co. IDAHO: Adams Co.; Bonneville Co.; Cassia Co.; Fremont Co.; Teton Co.; Valley Co. MONTANA: Lewis and Clark Co.; Missoula Co.; Ravalli Co. UTAH: Garfield Co.; Summit Co.; Uintah Co.; Utah Co.; Wasatch Co. WYOMING: Albany Co.; Lincoln Co.; Park Co.; Sublette Co.

FIGURE 456. — *Isoperla mormona* (Banks), adult, habitus.



456

Discussion. — This species is common in creeks and rivers in the Pacific Northwest but rare in the Rocky Mts. The adults emerge from March to July.

Isoperla quinquepunctata (Banks) (figs. 416, 454)

Chloroperla quinquepunctata Banks, 1902, 34: 124.
Isoperla quinquepunctata, Banks, 1906d, 17: 175.
Isoperla quinquepunctata, Needham and Claassen, 1925, 2: 151, male and female; figs. 7-8, 11, p. 343, male and female genitalia.
Isoperla quinquepunctata, Seemann, 1927, 19: 57, nymph; figs. 1-3, p. 63, nymph.

Type locality. — Las Vegas, New Mexico.

Geographic range. — Coast, Sierra Nevada and Rocky Mts.

Distribution in Rocky Mts. — (Central and Southern Rockies): ARIZONA: Apache Co. COLORADO: Archuleta Co.; Boulder Co.; Gilpin Co.; Rio Blanco Co.; Routt Co. NEW MEXICO: Rio Arriba Co. UTAH: Cache Co.; Iron Co.; Millard Co.; Salt Lake Co.; Wasatch Co.

Discussion. — This rare species occurs in creeks and rivers. The adults emerge from May to July.

Isoperla sordida (Banks) (figs. 420, 421, 455)

Perla sordida Banks, 1906a, 38: 338.
Isoperla sordida, Needham and Claassen, 1925, 2: 152, male and female; figs. 13-15, p. 345, male and female genitalia.

Type locality. — Los Angeles Co., California.

Geographic range. — Coast, Cascade, Rocky and Sierra Nevada Mts.

Distribution in Rocky Mts. — (Northern and Central Rockies): IDAHO: Lemhi Co.; Teton Co. MONTANA: Beaverhead Co.; Carbon Co.; Flathead Co.; Glacier Co.; Granite Co.; Judith Basin Co.; Lake Co.; Ravalli Co.

Discussion. — This species is found in creeks and rivers. The adults emerge from June to September.

Isoperla trictura (Hoppe) (figs. 440-443)

Perla trictura Hoppe, 1938, 4: 151, male and female; pl. 17, figs. 3-4, male and female genitalia.
Isoperla trictura, Frison, 1942b, 22: 336; fig. 114, p. 336, male and female genitalia.

Type locality. — Cedar River (Maple Valley), Washington.

Geographic range. — Coast, Cascade and Rocky Mts.

Distribution in Rocky Mts. — (Northern Rockies): IDAHO: Shoshone Co. MONTANA: Ravalli Co.

Discussion. — This rare species is found in creeks and rivers. The adults emerge from April to July.

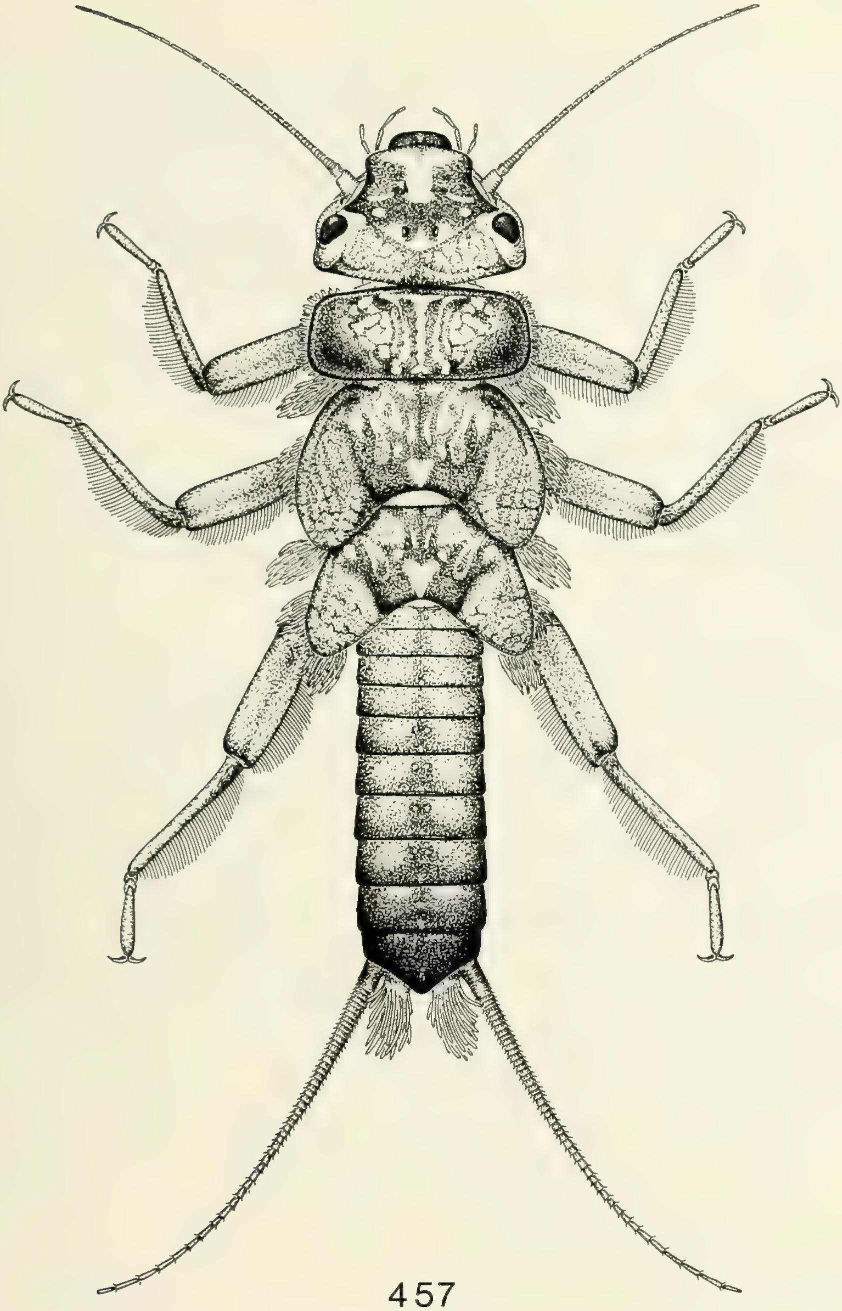


FIGURE 457. — *Hesperoperla pacifica* Banks, nymph, habitus.

Family **Perlidae**

The North American Perlidae are distinct from other stoneflies in lacking abdominal gills and in bearing profusely branched thoracic gills or gill remnants on the nymphs and adults. The terminal margins of both paraglossae and the shorter glossae are rounded. In the forewing, the cubital-anal crossvein is either within the anal cell or very close to it.

The family is comprised of two subfamilies both represented in the Rocky Mountain Fauna. The Acroneuriinae, tribe Acroneuriini, includes most of the western species. Males of the subfamily either lack a hammer or bear a large one on the ninth sternum (fig. 463). Genital hooks are absent from the tenth sternum and the sclerotized paraprocts recurve over the tenth tergum (figs. 469, 471). Nymphs differ in the completeness or lack of an occipital row of spinules (fig. 21).

The subfamily Perlinae is distinguished by the complete absence of a hammer, the poorly developed paraprocts and the prolonged genital hooks of the males (fig. 467). The row of spinules on the nymphal occiput is complete and distinctive (fig. 22). The two tribes represented are easily separated by the number of ocelli; Neoperlini with two and Perlini with three.

Determinations of genera and species are usually made on the basis of spinule and setal patterns on the occiput, thoracic margin, abdomen, aedeagus and vagina. Egg morphology has been shown by Stark and Gaufin (1976b) to be useful in distinguishing groups. Variations in collar type and chorionic reticulation are often species specific.

Key to the Subfamilies and Genera of Perlidae

Males

1. Genital hooks developed from hind margin of tenth tergum, anterior to cercal bases (fig. 467) .... PERLINAE 2
   Genital hooks developed from paraprocts, posterior to cercal bases (figs. 469, 471) .... ACRONEURIINAE 3
2. Three ocelli; ninth sternum with disc-like hammer .... *Claassenia*
   Two ocelli; ninth sternum without hammer .... *Neoperla*
3. Ninth sternum without hammer .... *Perlesta*
   Ninth sternum with hammer (fig. 463) 4
4. Tenth tergum with mesal tergite separated anteriorly and laterally by membranous areas (figs. 469, 471) 5
   Tenth tergum without separated mesal tergite but sometimes with areas of light sclerotization (fig. 458) 6
5. Hammer elongate, twice as long as wide .... *Calineuria*
   Hammer almost square .... *Hesperoperla*
6. Hammer oval (fig. 465) .... *Acroneuria*
   Hammer rectangular or triangular (fig. 463) .... *Doroneuria*

Females

1. Two ocelli .... *Neoperla*
   Three ocelli 2
2. Subgenital plate not produced (fig. 460) 3
   Subgenital plate slightly to strongly produced (fig. 472) 5
3. Eighth sternum with posteromesal notch bordered by U-shaped membranous area (fig. 470); collar of egg stalked .... *Calineuria*
   Eighth sternum without posteromesal U-shaped membranous area (fig. 466); collar of egg button-like (fig. 38) 4
4. Vagina lined with golden brown spinulae (fig. 461); chorion of egg punctate or smooth .... *Doroneuria*
   Vagina without spinulae; chorion of egg with apical mesh reticulation (fig. 38) .... *Claassenia*
5. Collar of egg stalked (fig. 37) 6
   Collar of egg button-like or absent 7
6. Apex of egg flanged around collar base (fig. 37); subgenital pate with posteromesal square area of dark sclerotization (fig. 472) .... *Hesperoperla*
   Apex of egg smooth and even around collar base; posteromesal area of subgenital plate unsclerotized (fig. 475) .... *Perlesta* (in part)
7. Vagina lined with spinule .... *Acroneuria*
   Vagina with sclerites or entirely membranous .... *Perlesta* (in part)

Nymphs

1. Occiput with transverse row of regularly spaced spinules, or with distinctly elevated transverse ridge (fig. 22) .... PERLINAE 2
   Occiput without spinules or with sinuate or incomplete row of irregularly spaced spinules (fig. 21) .... ACRONEURIINAE 3
2. Two ocelli .... *Neoperla*
   Three ocelli .... *Claassenia*
3. Occiput with nearly complete, sinuate row of irregularly spaced spinules behind ocelli 4
   Occiput with few scattered spinules near post-ocular fringe .... *Acroneuria*
4. Abdominal terga with few or no intercalary spinules (fig. 457) .... *Hesperoperla*
   Abdominal terga with numerous intercalary spinules 5
5. Cerci without fringe of long silky setae .... *Perlesta*
   Cerci with fringe of long silky setae 6
6. Dorsum of thorax and abdomen with longitudinal row of long silky setae; seventh sternum with incomplete posterior fringe .... *Doroneuria*
   Dorsum of thorax and abdomen without longitudinal row of long silky setae; seventh sternum usually with complete posterior fringe .... *Calineuria*

Subfamily Acroneuriinae

Tribe Acroneuriini

Genus ACRONEURIA Pictet 1841

The genus *Acroneuria* includes eleven species in North America. Only one species *A. abnormis* has expanded its range to the Rocky

Mountains. It entered the Rockies via the South Platte, Missouri and Saskatchewan river systems, which enter the eastern border of the study area. A questionable record of *A. internata* from Colorado cannot be confirmed as noted in Stark and Gaufin (1976a).

Males have a large oval hammer and patches of long spinules, arranged in species-specific patterns on the aedeagus. The subgenital plate of the female is slightly to strongly produced (fig. 466) and the vagina is lined with small brown spinules. Nymphs differ from other genera in the subfamily in having only a few stout spines scattered on the lateral margins of the occiput near the compound eyes.

Acroneuria abnormis (Newman) (figs. 465, 466)

Perla abnormis Newman, 1838, 5: 177.
Acroneuria depressa Needham and Claassen, 1922, 54: 253.
Acroneuria abnormis, Needham and Claassen, 1925, 2: 178, male and female; figs. 3-4, p. 347, male and female genitalia.
Acroneuria abnormis, Claassen, 1931, 3: 82, nymph; pl. 31, fig. 221, p. 187, nymph.

Type locality. — Trenton Falls, New York.

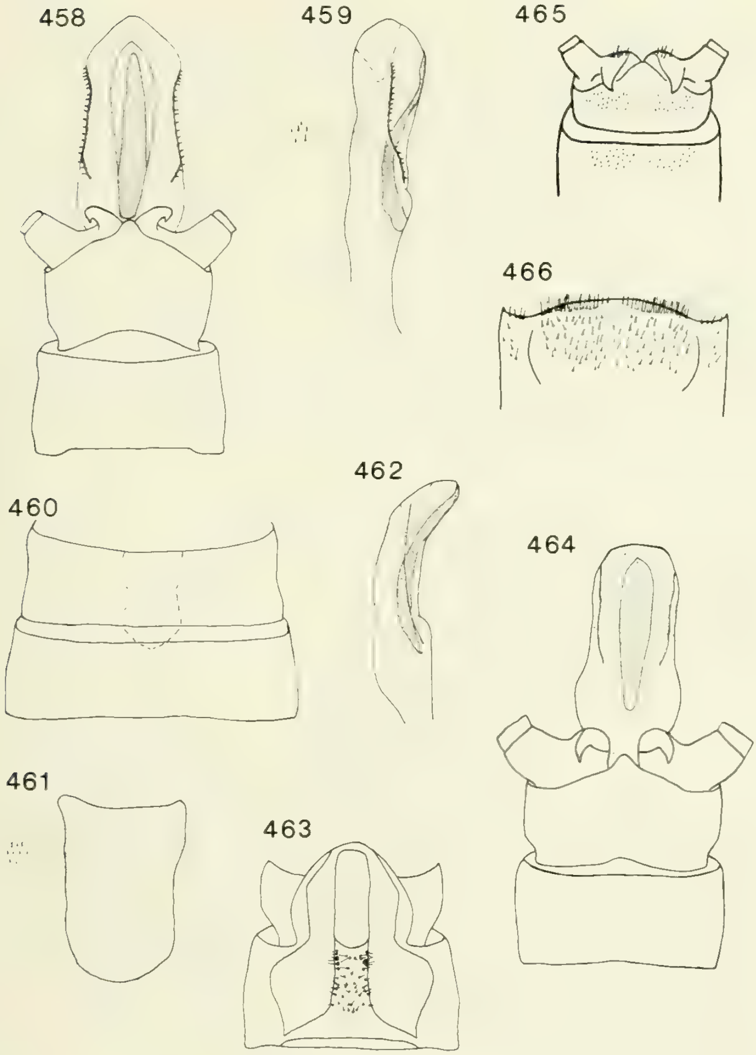
Geographic range. — Eastern and central United States and Canada.

Distribution in Rocky Mts. — (Canadian, Central and Southern Rockies): SASKATCHEWAN: South Saskatchewan River, Saskatoon. COLORADO: Garfield Co.; Mesa Co.; Moffat Co. MONTANA: Custer Co. UTAH: Daggett Co.; Uintah Co. WYOMING: Sweetwater Co.

Discussion. — The nymphs of this species have been incorrectly called both *Calineuria californica* and *Doroneuria theodora* in the past. The adults emerge from June to August.

Genus CALINEURIA Ricker 1954

The monotypic genus *Calineuria* ranges along the Pacific Coast and Northern Rockies. Males have a longitudinally rectangular hammer and a median, heavily sclerotized tergite on the tenth tergum (fig. 469). The basal portion of the aedeagus bears four spinule patches. Females are distinguished by the shallowly notched posterior margin of the slightly produced subgenital plate (fig. 470). An unsclerotized, U-shaped border surrounds the notch. Nymphs are characterized by a complete fringe of spines across the posterior margin of the seventh sternum. The dense fringe of long silky hairs on the mesal margin of the nymphal cerci originates in the whorl of spines on each segment. The egg chorion bears shallow, hexagonal reticulations.



FIGURES 458-466. — *Doroneuria baumanni* Stark and Gaufin: 458, male terminalia, dorsal view; 459, aedeagus, lateral view; 460, female abdominal sterna eight and nine; 461, vagina. *Doroneuria theodora* (Needham and Claassen): 462, aedeagus, lateral view; 463, male terminalia, ventral view; 464, male terminalia, dorsal view. *Acroneuria abnormis* (Newman): 465, male terminalia, dorsal view; 466, subgenital plate, female.

Calineuria californica (Banks) (figs. 469, 470)

Perla californica Banks, 1905, 1: 87.
Acroneuria californica, Needham and Claassen, 1925, 2: 192, male and female; figs. 17-20, p. 347, male and female genitalia.
Acroneuria (Calineuria) californica, Ricker, 1955, 51: 39.
Doroneuria californica, Illies, 1966, 82: 330.
Calineuria californica, Stark and Gaufin, 1974, 34: 85, male, female and nymph; figs. 1-3, p. 84, male and female genitalia.

Type locality. — Claremont, California.

Geographic range. — Coast, Cascade and Rocky Mts.

Distribution in Rocky Mts. — (Canadian and Northern Rockies): ALBERTA: No locality. BRITISH COLUMBIA: Marysville; Summerland. IDAHO: Boise Co.; Boundary Co.; Kootenai Co.; Lemhi Co.; Shoshone Co. MONTANA: Camas Co.; Flathead Co.; Lake Co.; Lincoln Co.; Missoula Co.; Pondera Co.; Ravalli Co. WASHINGTON: Spokane Co.

Discussion. — This is the most abundant perlid species in most rivers in the Pacific Northwest and it has extended its range into the Rocky Mountains where these faunal elements meet. The adults emerge from April through July.

Genus DORONEURIA Needham and Claassen 1922

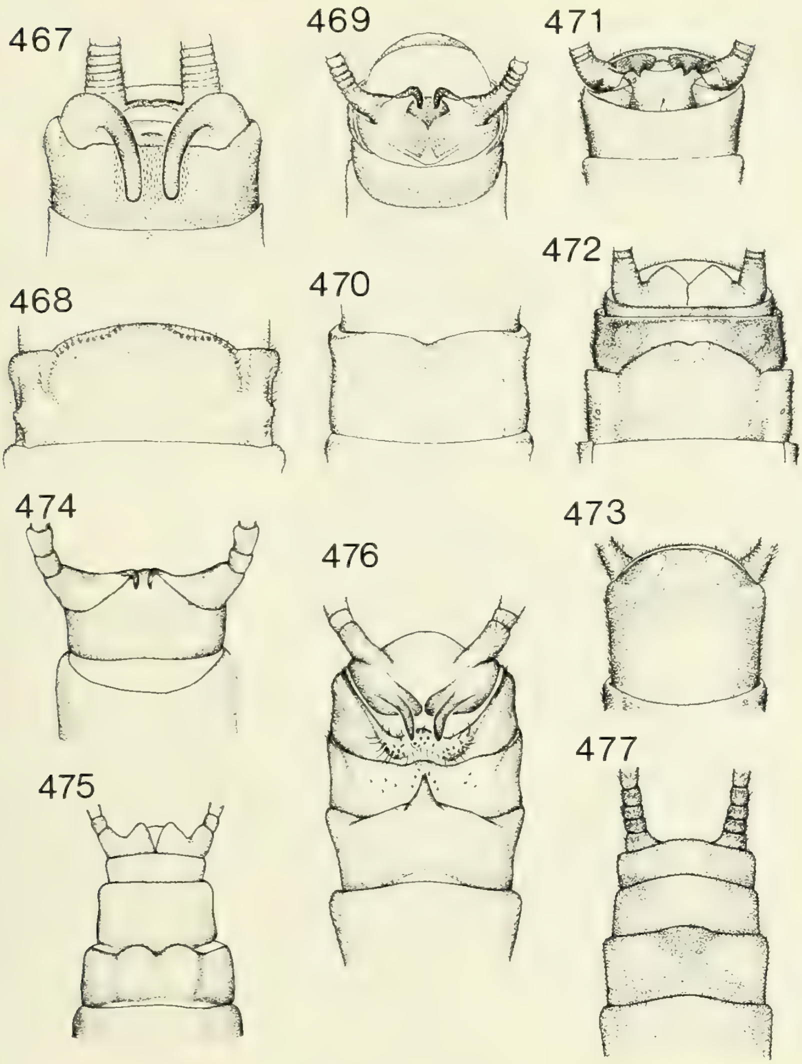
The two species in the genus *Doroneuria* are known only from western North America. Males are characterized by a longitudinally rectangular hammer (fig. 463). The aedeagus bears a spatulate sclerotized plate dorsally and two elongate, narrow, sclerotized bars laterally (fig. 459). The subgenital plate of the female is not produced (fig. 460). The vagina is lined with spinules, a character it shares among the Acroneuriinae with *Acroneuria* (fig. 461). Nymphs bear an incomplete fringe of spines on the posterior margin of the seventh abdominal sternum. The egg chorion is finely punctate or smooth.

Females and nymphs are presently indistinguishable when not associated with males.

Key to the Species of Doroneuria

Males

1. Lateral bars of aedeagus bearing twelve to twenty-two prominent spines (fig. 458) .... *baumanni*
   Lateral bars of aedeagus naked (fig. 464) .... *theodora*



FIGURES 467-477. — *Claassenia sabulosa* (Banks): 467, male terminalia, dorsal view; 468, subgenital plate, female. *Calineuria californica* (Banks): 469, male terminalia, dorsal view; 470, subgenital plate, female. *Hesperoperla pacifica* (Banks): 471, male terminalia, dorsal view; 472, female terminalia, ventral view; 473, male terminalia, ventral view. *Perlesta placida* (Hagen): 474, male terminalia, dorsal view; 475, female terminalia, ventral view. *Neoperla clymene* (Newman): 476, male terminalia, dorsal view; 477, female terminalia, ventral view.

Doroneuria baumanni Stark and Gaufin (figs. 458-461)

Acroneuria theodora, Frison, 1942b, 22: 284 (in part).
Doroneuria theodora, Illies, 1966, 82: 331 (in part).
Doroneuria baumanni Stark and Gaufin, 1974, 34: 88, male, female and nymph; figs. 5-8, p. 88, male and female genitalia.

Type locality. — Burney Falls State Park, California.

Geographic range. — Coast, Cascade and Rocky Mts.

Distribution in Rocky Mts. — (Canadian, Northern and Central Rockies): BRITISH COLUMBIA: Lumby; Oliver; Peachland; Nechako River; Prince George; Vernon. NEVADA: Elko Co. OREGON: Harney Co.

Discussion. — This species is most common near the Pacific Coast but extends into the Great Basin in the southern part of its range. Emergence of adults takes place from May to October.

Doroneuria theodora (Needham and Claassen) (figs. 462-464)

Acroneuria (Doroneuria) theodora Needham and Claassen, 1922, 54: 254.
Acroneuria theodora, Frison, 1942b, 22: 254 (in part).
Acroneuria (Calineuria) theodora, Ricker, 1955, 51: 39.
Doroneuria theodora, Illies, 1966, 82: 331.
Doroneuria theodora, Stark and Gaufin, 1974, 34: 90, male, female and nymph; figs. 9-11, p. 89, male and female genitalia.

Type locality. — Yellowstone National Park, Wyoming.

Geographic range. — Rocky Mountains.

Distribution in Rocky Mts. — (Canadian, Northern and Central Rockies): ALBERTA: Banff N. P., Spray River; Crows Nest River, Crows Nest. IDAHO: Adams Co.; Bonneville Co.; Boundary Co.; Idaho Co.; Kootenai Co.; Lemhi Co. MONTANA: Gallatin Co.; Granite Co.; Ravalli Co. WYOMING: Park Co.; Sheridan Co.

Discussion. — This sister species is found in the northern part of the Intermountain West and occurs in the headwaters of the Columbia River while *D. baumanni* occurs in the lower stretches. Adults emerge from June to September.

Genus HESPEROPERLA Banks 1938

The monotypic genus *Hesperoperla* is distributed commonly throughout western North America from Alaska to New Mexico. Males are distinguished by a large, quadrangular hammer and a single band of spines, incomplete ventrally, on the aedeagus. There is a median tergite on the tenth tergum; a character shared within the Acroneuriinae, only with the genus *Calineuria* (fig. 471). The subgenital plate of the female is strongly produced and emarginate (fig. 472). Nymphs are unique in

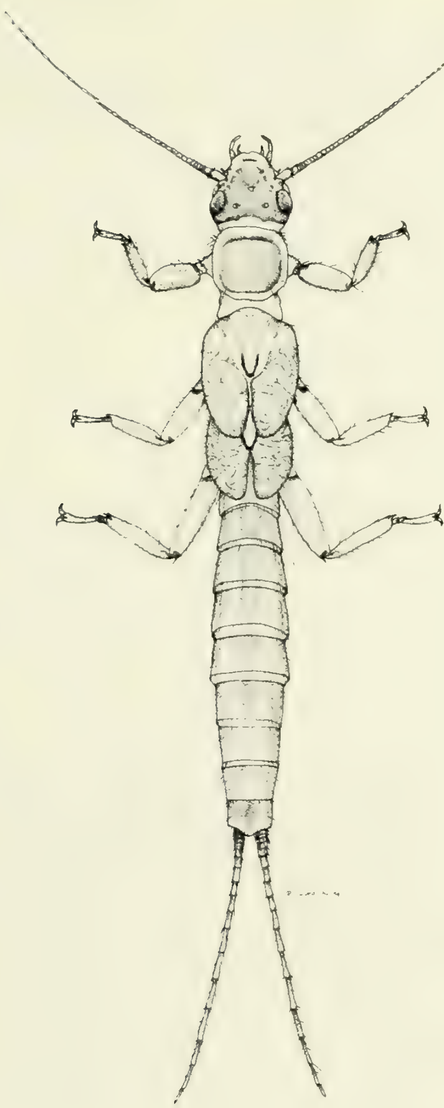


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FIGURE 478. — *Utaperla sopladora* Ricker, nymph, habitus.

having few or no intercalary spinules on the abdominal terga when mature. The egg chorion is smooth (fig. 37).

Hesperoperla pacifica (Banks) (figs. 21, 37, 457, 471-473)

Acroneuria pacifica Banks, 1900a, 26: 242.
Acroneuria nigrita Banks, 1904, 30: 98.
Acroneuria pumila Banks, 1906a, 38: 335.
Acroneuria ruficeps Klapalek, 1917, 14: 49.
Acroneuria pacifica, Needham and Claassen, 1925, 2: 187, male and female; figs. 7, 9-10, p. 349, male and female genitalia.
Acroneuria okanagan Ricker, 1935, 67: 262.
Acroneuria delta Claassen, 1937b, 10: 42.
Hesperoperla obscura Banks, 1938a, 45: 137.
Hesperoperla pacifica, Illies, 1966, 82: 336.

Type locality. — Olympia, Washington.

Geographic range. — Western North America.

Distribution in Rocky Mts. — (Canadian, Northern, Central and Southern Rockies): ALBERTA: Banff N. P., Red Earth Creek; Laggan; Jasper N. P., Maligne Lake; Waterton Lakes N. P. BRITISH COLUMBIA: Cranbrook; Creston; Fernie; Likely; Okanagan Lake; Oliver; Osoyoos; Prince George; Salmon Arm; Summerland; Wells Gray Park. ARIZONA: Apache Co.; Cochise Co.; Coconino Co.; Graham Co. COLORADO: Archuleta Co.; Boulder Co.; Chaffee Co.; Delta Co.; Eagle Co.; Fremont Co.; Gilpin Co.; Gunnison Co.; Hinsdale Co.; La Plata Co.; Larimer Co.; Mineral Co.; Montezuma Co.; Montrose Co.; Routt Co.; Saguache Co.; San Juan Co. IDAHO: Bonner Co.; Bonneville Co.; Franklin Co.; Lemhi Co. MONTANA: Beaverhead Co.; Carbon Co.; Flathead Co.; Gallatin Co.; Glacier Co.; Granite Co.; Lake Co.; Lewis and Clark Co.; Madison Co.; Missoula Co.; Park Co.; Powell Co.; Ravalli Co.; Stillwater Co.; Sweetgrass Co. NEVADA: White Pine Co. NEW MEXICO: Rio Arriba Co.; Sandoval Co.; San Miguel Co. OREGON: Wallowa Co. SOUTH DAKOTA: Lawrence Co. UTAH: Box Elder Co.; Cache Co.; Daggett Co.; Davis Co.; Duchesne Co.; Garfield Co.; Juab Co.; Millard Co.; Salt Lake Co.; San Juan Co.; Sevier Co.; Summit Co.; Tooele Co.; Uintah Co.; Utah Co.; Wasatch Co.; Washington Co.; Weber Co. WASHINGTON: Spokane Co.; Whitman Co. WYOMING: Albany Co.; Park Co.; Sublette Co.; Teton Co.; Uinta Co.

Discussion. — This species is the most widely distributed stonefly species in the Rocky Mountains. Throughout its range it exhibits a wide variation in size, wing length, coloration and shape of the female subgenital plate. However, in all cases studied, the aedeagus and ova are uniform. The adults emerge from April to October.

Genus PERLESTA Banks 1906

Several Nearctic species, including those in the *Perlesta placida* complex are distributed east of the Rocky Mountains. However, some representatives have crossed into the Central and Southern Rockies. Males are unique within the subfamily in lacking a hammer. The subgenital plate of the female is produced and slightly emarginate to distinctly notched mesally (fig. 475). The lateral margins of the nymphal pronotum are irregularly fringed. Many nymphs have a characteristic freckled appearance. The egg chorion is irregularly punctate or smooth.

Perlesta placida (Hagen) (figs. 474, 475)

Perla placida Hagen, 1861, 4: 28.
Perlesta placida, Needham and Claassen, 1925, 2: 158, male and female; figs. 15-16, p. 339, male and female genitalia.

Type locality. — Washington, D.C.

Geographic range. — North America.

Distribution in Rocky Mts. — (Central and Southern Rockies): ARIZONA: Pima Co. UTAH: Uintah Co. WYOMING: Platte Co.

Discussion. — This genus is common in eastern North America. It is highly vagile and is presently extending its range westward.

Tribe Neoperlini

Genus NEOPERLA Needham 1905

The Nearctic forms of the genus *Neoperla* generally occur in eastern North America with disjunct populations in Arizona and New Mexico. There are probably several species in North America lumped under the name *Neoperla clymene.*

The genus is unique among Rocky Mountain perlids in having only two ocelli. In the males the seventh abdominal tergum is produced posteriorly and tergum eight often bears a mesal process or spinule patch (fig. 476). The subgenital plate of the females is at most slightly produced (fig. 477). Nymphs bear a distinct transverse occipital ridge, with a few spinules laterally. The lateral margins of the pronotum lack a complete fringe.

Neoperla clymene (Newman) (figs. 476, 477)

Chloroperla clymene Newman, 1839, 3: 87.
Neoperla clymene, Needham and Claassen, 1925, 2: 134, male and female; figs. 1-5, p. 339, male and female genitalia, egg.
Neoperla clymene, Stewart, Baumann and Stark, 1974, 99: 527.

Type locality. — Georgia.

Geographic range. — North America.

Distribution in Rocky Mts. — (Southern Rockies): ARIZONA: No locality. NEW MEXICO: Santa Fe Co., 12 miles east of Santa Fe.

Discussion. — This species is common in eastern North America but is rare in the Rocky Mountain region. It emerges from June to September.

Subfamily Perlinae

Tribe Perlini

Genus CLAASSENIA Wu 1934

The genus *Claassenia* is represented in the Nearctic by one species which is distributed in western North America and east in Canada to the Hudson Bay. Males lack processes on abdominal terga one to nine, contrary to the other members of the Perlinae (fig. 467). The ninth sternum bears a large oval hammer. The subgenital plate of the female is not produced (fig. 468). The nymphal occiput is characterized by a regularly spaced, complete spinule row (fig. 22). The pronotum is fringed laterally with short, peg-like spines.

Claassenia sabulosa (Banks) (figs. 22, 38, 467, 468)

Perla sabulosa Banks, 1900a, 26: 242.
Adelungia arctica Klapalek, 1916, 13: 59.
Claassenia languida Needham and Claassen, 1925, 2: 100, male and female; figs. 18-20, p. 329, male and female genitalia.
Claassenia arctica, Frison, 1942b, 22: 286.
Claassenia sabulosa, Ricker, 1952, 18: 190.

Type locality. — Yakima, Washington.

Geographic range. — Northern and western North America.

Distribution in Rocky Mts. — (Canadian, Northern, Central and Southern Rockies): ALBERTA: Red Earth Creek, Banff N. P. BRITISH COLUMBIA: Coal River; Peace River; Marysville. ARIZONA: Apache Co. COLORADO: Archuleta Co.; Delta Co.; Eagle Co.; Garfield Co.; Grand Co.; Gunnison Co.; La Plata Co.; Larimer Co.; Mesa Co.; Moffat Co.; Montezuma Co.; Montrose Co.; Rio Blanco Co.; Rio Grande Co.; Routt Co.; Saguache Co. IDAHO: Bonneville Co.; Lemhi Co.; Teton Co. MONTANA: Broadwater Co.; Cascade Co.; Carbon Co.; Flathead Co.; Gallatin Co.; Granite Co;. Lake Co.; Lewis and Clark Co.; Lincoln Co.; Madison Co.; Park Co.; Ravalli Co.; Stillwater Co.; Sweet Grass Co.; Yellowstone Co. NEW MEXICO: Lincoln Co. UTAH: Daggett Co.; Duchesne Co.; Salt Lake Co.; Summit Co.; Uintah Co.; Utah Co.; Wasatch Co.; Weber Co. WYOMING: Park Co.

Discussion. — This species is a top carnivore and the mature nymphs are extremely active. It emerges from June to September.

Family **Chloroperlidae**

The family Chloroperlidae in the Rocky Mountains comprises two subfamilies, eight genera and twenty-three species.

Most chloroperlid adults can be distinguished from other stoneflies by their reduced wing venation, oval pronotum and delicate yellow, green or olive drab coloration. The genus *Utaperla,* however, is sometimes confused with the genus *Capnia* by inexperienced students because of its dark coloration. Forking in the second anal vein of the forewing easily separates the chloroperlids from the perlodids.

The nymphs of Chloroperlidae differ from those of other families in Systellognatha by their short cerci, lack of distinct color patterns, rounded wing pads and complete absence of external gills (figs. 15, 478). The body is tubular-shaped and bristled; well adapted to burrowing in the fine gravel of streambeds.

In 1943 and 1952 Ricker recognized subgenera in the subfamily Chloroperlinae based on external morphology and color patterns (figs. 554-558). The subgenera have since been given generic status by Illies (1966).

Several species in the family Chloroperlidae which have been reported from the Rocky Mountains have been omitted from this study because the records are questionable and unconfirmed. These species are: *Hastaperla brevis* (Banks), *Sweltsa fraterna* (Frison), *S. exquisita* (Frison), *S. occidens* (Frison) and *S. pacifica* (Banks). Because of the possibility that they may occur in our area, the *Sweltsa* species are included in the key, but they are not illustrated.

Key to the Subfamilies and Genera of Chloroperlidae

Males

1. Eyes set far forward (except in Utaperla) (figs. 548, 549, 550); body narrow and elongate; anal area of hindwings of normal size PARAPERLINAE 2
   Eyes normally situated (figs. 546, 547); body less elongate; anal area of hindwings often reduced or absent .... CHLOROPERLINAE 4
2. Head longer than wide (fig. 548) .... *Kathroperla*
   Head about as long as wide (figs. 549, 550) 3
3. Ocellar area dark (fig. 550); apex of epiproct simple (fig. 539); posterior margin of seventh sternum not raised and hairy (fig. 540) .... *Paraperla*
   Ocellar area light (fig. 549); apex of epiproct bifurcate (fig. 536); posterior margin of seventh sternum raised and hairy (fig. 537) .... *Utaperla*

4. Basal segment of cerci elongated, concave inward, bearing sharp spine basally and four blunt knobs distally; ninth tergum produced posteriorly with stout forward-pointing decurved hook (figs. 544, 545) .... *Neaviperla*
   Cerci normal; ninth tergum without median forward-projecting hook 5
5. Finger-like inward pointing process at base of each cercus; membranous epiproct ending in small hairy process (fig. 488) .... *Suwallia*
   No process at base of cerci (fig. 479); elongate epiproct ending in large process 6
6. Color light green in life (yellow in *delicata*); dark dorsal abdominal stripe absent (except in *pilosa*) (fig. 558); no terminal process on ninth tergum (fig. 482) .... *Alloperla*
   Color yellow in life; dark dorsal abdominal stripe present (fig. 554); often a process on ninth tergum (fig. 516) 7
7. Epiproct, with terminal process, in groove on tenth tergum (figs. 515, 516) .... *Sweltsa*
   Epiproct obscure, on surface of tenth tergum or in slight depression (figs. 527, 528) .... *Triznaka*

Females

1. Eyes set far forward (except in Utaperla) (figs. 548, 549, 550); body narrow and elongate; anal area of hindwings of normal size .... PARAPERLINAE 2
   Eyes normally situated (figs. 546, 547); body less elongate; anal area of hindwing often reduced or absent .... CHLOROPERLINAE 4
2. Head longer than wide (fig. 548) .... *Kathroperla*
   Head about as long as wide (figs. 549, 550) 3
3. Ocellar area dark; ecdysial cleavage line running through posterior ocelli triangular (fig. 550) .... *Paraperla*
   Ocellar area light; ecdysial cleavage line running through posterior ocelli truncate (fig. 549) .... *Utaperla*
4. First cercal segment three times as long as second, slightly concave inside, with one or two sutures near tip .... *Neaviperla*
   First cercal segment little longer than second 5
5. Green in life (yellow in *delicata*); dark dorsal abdominal stripe absent (except in *pilosa*) (fig. 558) .... *Alloperla*
   Yellow in life; dark dorsal abdominal stripe present 6
6. Subgenital plate with distinct notch (fig. 517) .... *Sweltsa* (in part)
   Subgenital plate rounded, slightly indented or pointed (fig. 523) 7
7. Head and/or pronotum with dark or dusky reticulate markings (figs. 547, 553, 554) .... *Sweltsa* (in part)
   Head and pronotum lacking dark reticulate markings or marked otherwise (figs. 555, 557) 8
8. Head and pronotum unmarked except for black lateral margins on pronotum .... *Sweltsa* (in part)
   Head and pronotum otherwise 9
9. Head marked with distinct black patches or if unmarked, pronotum dusky on lateral margins (fig. 555) .... *Triznaka*
   Head unmarked; pronotum margined in black or with median black stripe (fig. 557) .... *Suwallia*

Subfamily Chloroperlinae

Genus ALLOPERLA Banks 1906

The adults of the genus *Alloperla* are bright green except for the yellow *A. delicata.* All but one species, *A. pilosa,* lack a dark abdominal stripe (fig. 558). Some dusky patches may mark the head and pronotum, but they are usually free from any dark coloring. In most species, the epiproct consists of a long curved rod-like base with a small process at the tip (fig. 482).

Key to the Species of Alloperla

Males

1. Longitudinal black stripe on abdominal terga one to eight .... *pilosa*
   No black stripe on abdominal terga (fig. 558) 2
2. Tip of epiproct longer than wide 3
   Tip of epiproct wider than long 4
3. Tip of epiproct ending in three small points (figs. 509, 510) .... *medveda*
   Tip of epiproct uniformly rounded (figs. 484, 485) .... *severa*
4. Tip of epiproct ellipsoidal, edged with many short ventrally directed spines (figs. 481, 482) .... *serrata*
   Tip of epiproct ending in two anterolateral points (fig. 479) .... *delicata*

Females

1. Longitudinal black stripe on abdominal terga one to eight .... *pilosa*
   No black stripe on abdominal terga (fig. 558) 2
2. Tip of subgenital plate rounded and projecting beyond posterior margin of next segment (fig. 486) .... *severa*
   Tip of subgenital plate tapered in triangular shape and projecting partially over next segment (figs. 480, 483, 508) 3
3. Entire subgenital plate triangular-shaped, with concave sides (fig. 480) *delicata*
   Subgenital plate with rounded sides basally, tapering concavely to terminal median triangle (figs. 483, 508) 4
4. Triangular apex one third width of subgenital plate; only apex projecting partially over next segment (fig. 483) .... *serrata*
   Triangular apex one fourth width of subgenital plate; convex base and apex projecting completely over next segment (fig. 508) .... *medveda*

Alloperla delicata Frison (figs. 479, 480)

Alloperla delicata Frison, 1935, 61: 334, male; figs. 23-24, 29, male genitalia.
Alloperla (*Alloperla*) *delicata,* Jewett, 1954, 11: 549, female; fig. 12, p. 544, female genitalia.

Type locality. — Oak Creek, Corvallis, Oregon.

Geographic range. — Coast, Cascade, Rocky and Sierra Nevada Mts.

Distribution in Rocky Mts. — (Canadian and Northern Rockies):

ALBERTA: Kananaskis River. IDAHO: Idaho Co. MONTANA: Flathead Co.; Gallatin Co.; Missoula Co.; Ravalli Co.

Discussion. — This species is abundant in creeks and small rivers in the Pacific Northwest. A record in Gaufin, et al. (1966) from Box Elder Co., Utah, proved to be *Alloperla severa.* Not all of the records from Montana could be confirmed and may also represent the latter species. The adults emerge from April to August.

Alloperla medveda Ricker (figs. 508-510)

Alloperla (Alloperla) medveda Ricker, 1952, 18: 177, male and female; fig. 137, p. 179, male genitalia.

Type locality. — Beartooth Mts., Montana.

Geographic range. — Coast, Cascade and Rocky Mts.

Distribution in Rocky Mts. — (Canadian, Northern and Central Rockies): ALBERTA: Banff N. P. BRITISH COLUMBIA: Kamloops. IDAHO: Boise Co.; Lemhi Co. MONTANA: Carbon Co.; Cascade Co.; Flathead Co.; Gallatin Co.; Glacier Co.; Granite Co.; Judith Basin Co.; Kootenai Co.; Lincoln Co.; Meagher Co.; Missoula Co.; Park Co.; Ravalli Co.; Silver Bow Co.; Stillwater Co.; Sweet Grass Co. WYOMING: Park Co.; Teton Co.

Discussion. — This species is found in creeks and small rivers. The adults emerge from April to August.

Alloperla pilosa Needham and Claassen (figs. 506, 507)

Alloperla pilosa Needham and Claassen, 1925, 2: 124, male and female; figs. 7-9, p. 331, male and female genitalia.
Alloperla (Sweltsa) pilosa, Gaufin, 1964c, 34/35: 45.
Sweltsa pilosa, Illies, 1966, 82: 456.

Type locality. — Boulder, Colorado.

Geographic range. — Colorado.

Distribution in Rocky Mts. — (Southern Rockies): COLORADO: Boulder Co.; Grand Co.; Larimer Co.; Clear Creek Co.; Summit Co.

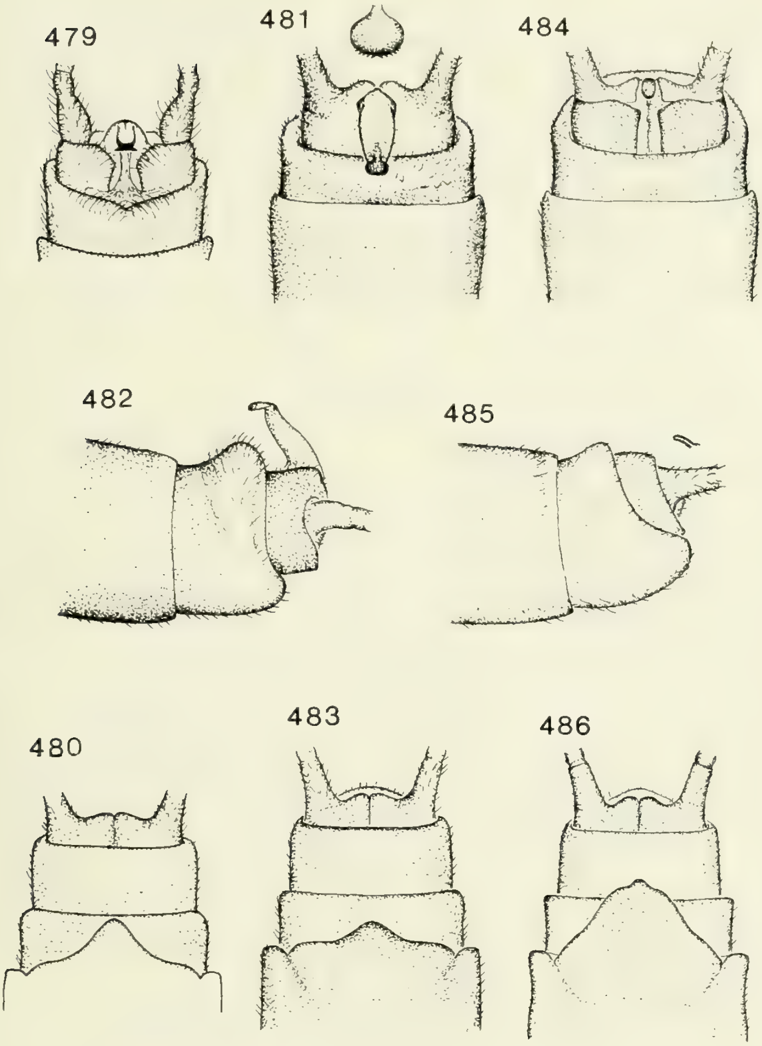
Discussion. — This species has been collected only in the Colorado Rockies. It occurs in small creeks at high elevations. The adults emerge in June and July.

Alloperla serrata Needham and Claassen (figs. 481-483)

Alloperla serrata Needham and Claassen, 1925, 2: 124, male and female; figs. 12-13, p. 331, male and female genitalia.

Type locality. — Moraine Lake, Alberta.

Geographic range. — Coast, Cascade and Rocky Mts.



FIGURES 479-486. — *Alloperla delicata* Frison: 479, male terminalia, dorsal view; 480, female terminalia, ventral view. *Alloperla serrata* Needham and Claassen: 481, male terminalia, dorsal view; 482, male terminalia, lateral view; 483, female terminalia, ventral view. *Alloperla severa* Hagen: 484, male terminalia, dorsal view; 485, male terminalia, lateral view; 486, female terminalia, ventral view.

Distribution in Rocky Mts. — (Canadian, Northern and Central Rockies): ALBERTA: Banff N. P., Bow River; Moraine Creek. BRITISH COLUMBIA: Glacier N. P.; Kootenay N. P.; Purcell Range; Selkirk Range; Summit Lake; Yoho N. P. IDAHO: Boise Co. MONTANA: Broadwater Co.; Carbon Co.; Cascade Co.; Flathead Co.; Gallatin Co.; Glacier Co.; Granite Co.; Lake Co.; Meagher Co.; Missoula Co.; Park Co.; Ravalli Co.; Sweet Grass Co. WYOMING: Sublette Co.

Discussion. — This species is found in creeks. The adults emerge from April to August.

Alloperla severa (Hagen) (figs. 484-486, 546)

Perla severa Hagen, 1861, 4: 30.

Alloperla elevata Frison, 1935, 61: 335, male and female; pl. 12, figs. 11-12, male genitalia; pl. 14, fig. 41, female genitalia.

Alloperla (*Alloperla*) *thalia* Ricker, 1952, 18: 178, male and female; figs. 131, 134, p. 179, male and female genitalia.

Type locality. — Alaska.

Geographic range. — Coast, Cascade and Rocky Mts.

Distribution in Rocky Mts. — (Canadian, Northern, Central and Southern Rockies): ALBERTA: Banff N. P., Bow River. BRITISH COLUMBIA: Armstrong; Prince George; Quesnel; Peace River; Wells Gray Park. COLORADO: Grand Co.; Routt Co. IDAHO: Adams Co.; Bannock Co.; Bonneville Co.; Custer Co.; Fremont Co.; Lemhi Co.; Teton Co. MONTANA: Beaverhead Co.; Big Horn Co.; Cascade Co.; Deer Lodge Co.; Fergus Co.; Flathead Co.; Gallatin Co.; Glacier Co.; Golden Valley Co.; Granite Co.; Judith Basin Co.; Lake Co.; Lewis and Clark Co.; Meagher Co.; Missoula Co.; Park Co.; Pondera Co.; Powell Co.; Ravalli Co.; Sanders Co.; Silver Bow Co.; Stillwater Co.; Sweet Grass Co.; Wheatland Co. NEVADA: Elko Co.; White Pine Co. UTAH: Box Elder Co.; Duchesne Co.; Salt Lake Co.; Tooele Co.; Uintah Co.; Utah Co.; Wasatch Co. WYOMING: Lincoln Co.; Sublette Co.

Discussion. — This species is common in creeks in the Rocky Mountain region. The adults emerge from May to September.

Genus NEAVIPERLA Ricker 1943

The monotypic genus *Neaviperla* is unique in the elongation of the first cercal segment and its modification in the male (figs. 544, 545). The hind margin of the male tenth tergum bears an erect process. Adults are yellow, with a dark pronotal margin and a median abdominal stripe extending to segment seven (fig. 556).

Neaviperla forcipata (Neave) (figs. 544, 545, 556)

Alloperla forcipata Neave, 1929, 4: 160, male; pl. 1, figs. 1-2, male genitalia.
Alloperla (*Neaviperla*) *forcipata*, Ricker, 1943, 12: 142, female; fig. 129, p. 140, female genitalia.
Neaviperla forcipata, Illies, 1966, 82: 448.

Type locality. — Lake Edith, Alberta.

Geographic range. — Coast, Cascade and Rocky Mts.

Distribution in Rocky Mts. — (Canadian and Northern Rockies): ALBERTA: Lake Edith; Banff N. P. BRITISH COLUMBIA: Bowron Park. MONTANA: Flathead Co.; Glacier Co.

Discussion. — This species is found in creeks and small rivers. The adults emerge from July to September.

Genus SUWALLIA Ricker 1943

Males of the genus *Suwallia* are characterized by a slender, curved finger-like process projecting inward near the base of each cercus (fig. 487). The epiproct is membranous, with a small hairy, lightly chitinized tip (fig. 488).

The three species common in the Rocky Mountain area are easily separated by color pattern and by structures on the male aedeagus (fig. 557).

Key to the Species of Suwallia

Males

1. Median longitudinal dark line extending from base of head to tip of abdomen; single V-shaped patch of sclerotized spinules on aedeagus (fig. 493) .. *lineosa*
   Median longitudinal dark line not continuous; aedeagus otherwise 2
2. Pale yellow; three sclerotized patches of tiny spinules on aedeagus (fig. 497) .... *pallidula*
   Yellow-brown; long, slender darkly sclerotized appendage on center of aedeagus (fig. 489) .... *autumna*

Females

1. Median longitudinal dark line extending from base of head to tip of abdomen; tip of subgenital plate slightly truncate (fig. 494) .... *lineosa*
   Median longitudinal dark line not continuous; tip of subgenital plate rounded .. 2
2. Pale yellow; sclerotized base of subgenital plate broadly connected to segment along entire width (fig. 498) .... *pallidula*
   Yellow-brown; sclerotized base of subgenital plate indented and narrowly connected to segment along one fourth of width (fig. 490) .... *autumna*

Suwallia autumna (Hoppe) (figs. 487-490)

Alloperla autumna Hoppe, 1938, 4: 152, male and female; figs. 5-6, p. 171, male and female genitalia.

Alloperla (Suwallia) autumna, Ricker, 1943, 12: 139.
Suwallia autumna, Illies, 1966, 82: 449.

Type locality. — North Fork Snoqualmie River, North Bend, Washington.

Geographic range. — Coast, Cascade and Rocky Mts.

Distribution in Rocky Mts. — (Canadian, Northern, and Central Rockies): ALBERTA: Banff N. P. IDAHO: Blaine Co.; Camas Co.; Custer Co. MONTANA: Flathead Co.; Glacier Co.; Lake Co.; Lewis and Clark Co.; Missoula Co.; Ravalli Co.; Sweet Grass Co. WYOMING: Albany Co.; Park Co.

Discussion. — This species is found in small rivers and creeks. The adults emerge from June to October.

Suwallia lineosa (Banks) (figs. 491-494)

Alloperla lineosa Banks, 1918, 62: 7.
Alloperla lineosa, Needham and Claassen, 1925, 2: 123, male and female; figs. 10-11, p. 331, male and female genitalia.
Alloperla (Suwallia) lineosa, Jewett, 1955, 13: 151; fig. 8, p. 153, male aedeagus.
Suwallia lineosa, Illies, 1966, 82: 449.

Type locality. — Grant, Colorado.

Geographic range. — Coast, Cascade and Rocky Mts.

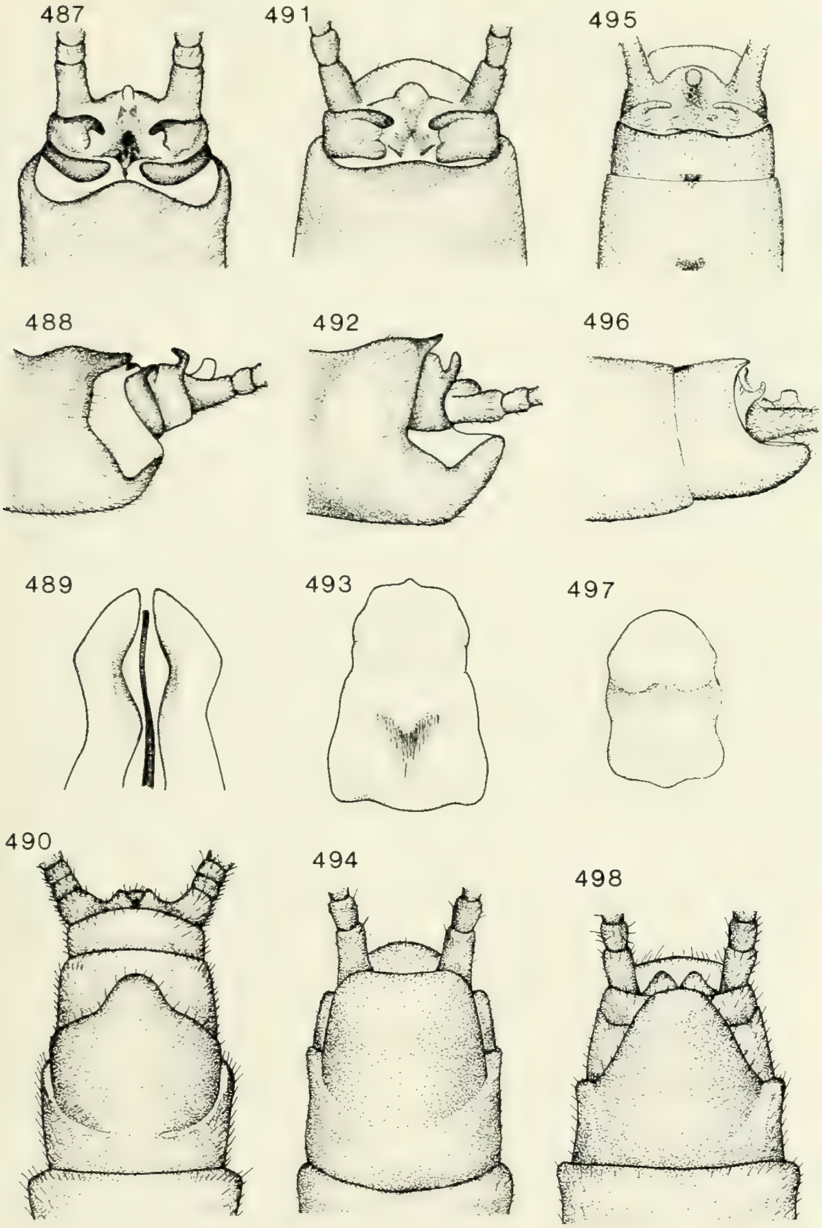
Distribution in Rocky Mts. — (Canadian, Northern, Central and Southern Rockies): BRITISH COLUMBIA: Douglas Lake. COLORADO: Gilpin Co.; La Plata Co.; Larimer Co.; Park Co.; Routt Co.; Gunnison Co. IDAHO: Blaine Co.; Bonneville Co.; Camas Co.; Custer Co.; Minidoka Co. MONTANA: Carbon Co.; Flathead Co.; Gallatin Co.; Glacier Co.; Lewis and Clark Co.; Missoula Co.; Powell Co.; Ravalli Co. UTAH: Duchesne Co.; Summit Co.; Uintah Co. WYOMING: Albany Co.; Carbon Co.; Park Co.; Teton Co.

Discussion. — This species is found in creeks and small rivers. The adults emerge in May to September.

Suwallia pallidula (Banks) (figs. 495-498)

Chloroperla pallidula Banks, 1904, 30: 99.
Alloperla pallidula, Needham and Claassen, 1925, 2: 108, male and female; figs. 12-13, p. 335, male and female genitalia.
Alloperla dubia Frison, 1935, 61: 338.

FIGURES 487-498. — *Suwallia autumna* (Hoppe): 487, male terminalia, dorsal view; 488, male terminalia, lateral view; 489, aedeagus; 490, female terminalia, ventral view. *Suwallia lineosa* (Banks): 491, male terminalia, dorsal view; 492,



male terminalia, lateral view; 493, aedeagus; 494, female terminalia, ventral view. *Suwallia pallidula* (Banks): 495, male terminalia, dorsal view; 496, male terminalia, lateral view; 497, aedeagus; 498, female terminalia, ventral view.

Alloperla (*Suwallia*) *pallidula*, Ricker, 1943, 12: 141.
Suwallia pallidula, Illies, 1966, 82: 450.

Type locality. — Beulah, New Mexico.

Geographic range. — Coast, Cascade, Rocky and Sierra Nevada Mts.

Distribution in Rocky Mts. — (Canadian, Northern, Central and Southern Rockies): ALBERTA: Banff N. P. BRITISH COLUMBIA: Bowron Park; Douglas Lake; Kamloops; Kaslo; Kokanee Mt.; Kootenai N. P.; Prince George; Quesnel; Salmon Arm; Slocan City; Summerland; Tete Jaune Cache; Vermillion River; Wells Gray Park; Yoho N. P. ARIZONA: Apache Co.; Cochise Co.; Graham Co. COLORADO: Boulder Co.; Chaffee Co.; Clear Creek Co.; Delta Co.; Eagle Co.; Garfield Co.; Gilpin Co.; Grand Co.; Gunnison Co.; Hinsdale Co.; Lake Co.; La Plata Co.; Larimer Co.; Montrose Co.; Ouray Co.; Park Co.; Rio Blanco Co.; Routt Co.; Saguache Co.; Summit Co.; Teller Co. IDAHO: Adams Co.; Blaine Co.; Bonner Co.; Bonneville Co.; Caribou Co.; Custer Co.; Fremont Co.; Idaho Co.; Lemhi Co.; Power Co.; Teton Co.; Twin Falls Co.; Valley Co.; Washington Co. MONTANA: Beaverhead Co.; Broadwater Co.; Carbon Co.; Cascade Co.; Deer Lodge Co.; Flathead Co.; Gallatin Co.; Glacier Co.; Granite Co.; Jefferson Co.; Judith Basin Co.; Lake Co.; Lewis and Clark Co.; Lincoln Co.; Madison Co.; Meagher Co.; Missoula Co.; Park Co.; Pondera Co.; Powell Co.; Ravalli Co.; Silver Bow Co.; Sweet Grass Co.; Wheatland Co. OREGON: Baker Co.; Grant Co.; Wallowa Co. NEW MEXICO: Lincoln Co.; San Miguel Co.; Taos Co. UTAH: Beaver Co.; Daggett Co.; Cache Co.; Davis Co.; Duchesne Co.; Salt Lake Co.; San Juan Co.; Sevier Co.; Summit Co.; Tooele Co.; Uintah Co.; Utah Co.; Wasatch Co. WASHINGTON: Spokane Co. WYOMING: Albany Co.; Big Horn Co.; Caribou Co.; Carbon Co.; Platte Co.; Park Co.; Sheridan Co.; Sweetwater Co.; Sublette Co.; Teton Co.; Uinta Co.

Discussion. — This species is perhaps the most common and widespread member of the family in the Rocky Mountains. The adults emerge from May to October.

Genus SWELTSA Ricker 1943

The species comprising the genus *Sweltsa* are similar in appearance and the females are especially difficult to separate. Reticulate dark markings on either head or pronotum characterize several species (figs. 547, 553, 554). Others are almost completely yellow except for a dark pronotal margin and abdominal stripe. In most species, there is a transverse elevated process near the front margin of the ninth tergum of the male (fig. 516).

Key to the Species of Sweltsa

Males

1. No definite elevated transverse notched process on anterior border of ninth tergum 2
   Definite elevated transverse notched process near anterior border of ninth tergum (figs. 503, 522) 3
2. Pronotal margins and U-shaped marks on thorax black; epiproct long, nearly cylindrical and blunt at tip .... *occidens* *
   Pronotal margins and U-shaped marks on thorax pale grey; epiproct small, constricted medially and rounded at tip .... *fraterna* *
3. Bifurcate transverse process on eighth tergum .... *pacifica* *
   No process on eighth tergum 4
4. Pronotal disc yellow .... *exquisita* *
   Pronotal disc with black or dusky markings 5
5. Epiproct slender, expanded toward tip in dorsal view (fig. 524) 6
   Epiproct stout, broadly flattened in dorsal view 8
6. Tip of epiproct about twice as broad as base in dorsal view .... *fidelis*
   Tip of epiproct approximately the same width as base 7
7. Epiproct narrow throughout width in both dorsal and lateral views .... *borealis*
   Epiproct expanded in anterior third in dorsal and lateral views .... *revelstoka*
8. Sclerotized leaf-like appendage arising from base of aedeagus 9
   No sclerotized appendage at base of aedeagus .... *coloradensis*
9. Leaf-like appendage large and lightly sclerotized (fig. 501) .... *gaufini*
   Leaf-like appendage small and darkly sclerotized (figs. 505, 511) 10
10. Leaf-like appendage elongate; median carina of epiproct low (fig. 511) .... *albertensis*
   Leaf-like appendage short and broad; median carina of epiproct high (fig. 505) .... *lamba*

Females

1. Subgenital plate notched (fig. 526) 2
   Subgenital plate entire (fig. 504, 523) 4
2. Notch in subgenital plate forked (fig. 526) .... *fidelis*
   Notch in subgenital plate simple (fig. 520) 3
3. Notch in subgenital plate shallow and broad (fig. 520) .... *borealis*
   Notch in subgenital plate deep and thin (fig. 517) .... *revelstoka*
4. Only lateral margins of pronotum dark; head and central pronotum mostly without dark markings 5
   Almost entire margin of pronotum dark; head and central pronotum with some dark markings (figs. 547, 553) 8
5. Lateral margins of pronotal disc with dusky band that occupies one fourth width .... *fraterna* *
   Lateral margins of pronotal disc with narrow dark band 6
6. Subgenital plate thickened laterally .... *pacifica* *
   Subgenital plate not thickened laterally 7
7. Subgenital plate square .... *exquisita* *
   Subgenital plate rounded or slightly tapered to end .... *occidens* *

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* Signifies species not presently known from the Rocky Mountains.

8. Tip of subgenital plate narrowly truncate, one half width of base and not projecting completely beyond next segment (fig. 523) .... *coloradensis*
   Tip of subgenital plate rounded; one third width of base and projecting to posterior margin of next segment (figs. 500, 504, 514) .... *albertensis, gaufini, lamba*

Sweltsa albertensis (Needham and Claassen) (figs. 511-514)

Alloperla albertensis Needham and Claassen, 1925, 2: 116, male and female; figs. 6-7, p. 335, male and female genitalia.
Alloperla (*Sweltsa*) *albertensis,* Jewett, 1959, 3: 84.
Sweltsa albertensis, Illies, 1966, 82: 450.

Type locality. — Waterton Lakes, Alberta.

Geographic range. — Rocky Mts.

Distribution in Rocky Mts. — (Canadian, Northern, Central and Southern Rockies): ALBERTA: Waterton Lakes N. P. COLORADO: Boulder Co.; Clear Creek Co.; Larimer Co. IDAHO: Blaine Co.; Boise Co.; Caribou Co.; Cassia Co.; Camas Co.; Custer Co.; Fremont Co.; Lemhi Co.; MONTANA: Beaverhead Co.; Broadwater Co.; Carbon Co.; Cascade Co.; Flathead Co.; Gallatin Co.; Glacier Co.; Granite Co.; Judith Basin Co.; Lewis and Clark Co.; Meagher Co.; Missoula Co.; Park Co.; Powell Co.; Ravalli Co.; Stillwater Co.; Sweet Grass Co. WYOMING: Albany Co.; Park Co.

Discussion. — This species is particularly common in creeks and small rivers in the Northern Rockies. The adults emerge from May to August.

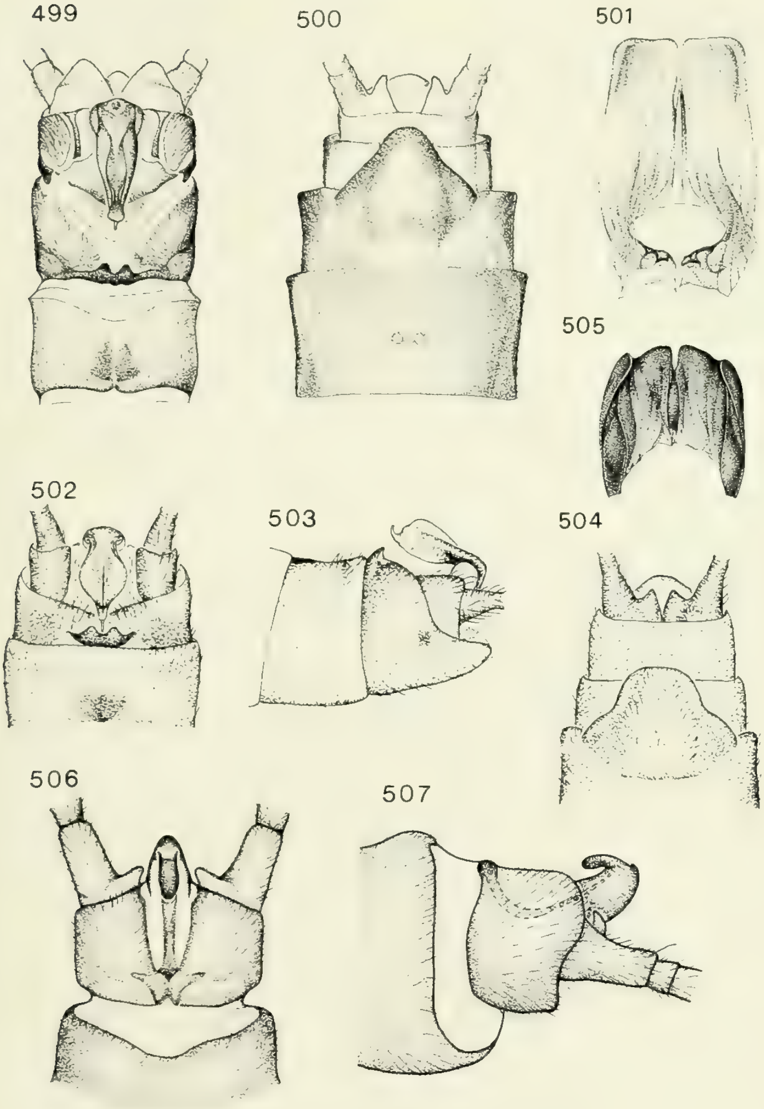
Sweltsa borealis (Banks) (figs. 43, 518-520)

Chloroperla borealis Banks, 1895, 22: 313.
Alloperla borealis, Needham and Claassen, 1925, 2: 118, male and female; figs. 1-3, p. 333, male and female genitalia.
Alloperla borealis, Claassen, 1931, 3: 60, nymph; figs. 89-93, p. 137, nymphal mouthparts; fig. 192, p. 159, nymph.
Alloperla (*Sweltsa*) *borealis,* Ricker, 1943, 12: 135.
Sweltsa borealis, Illies, 1966, 82: 450.

Type locality. — Olympia, Washington.

Geographic range. — Coast, Cascade, Rocky and Sierra Nevada Mts.

Distribution in Rocky Mts. — (Canadian, Northern, Central and Southern Rockies): ALBERTA: Banff N. P. BRITISH COLUMBIA: Campbell Cr.; Glacier N. P.; Kaslo; Mission City; Mt. Revelstoke; Sproule Creek, Kootenay Dist.; Summerland. COLORADO: Boulder Co.; Clear Creek Co.; Delta Co.; Eagle Co.; Grand Co.; Gunnison Co.; Hinsdale Co.; La Plata Co.; Larimer Co.; Park Co.; Routt Co.; Summit Co. IDAHO: Boise Co.; Bonneville Co.; Butte Co.; Custer Co.; Franklin Co.; Fremont Co.; Idaho Co.; Lemhi Co.; Mariposa Co.; Shoshone



FIGURES 499-507. — *Sweltsa gaufini* Baumann: 499, male terminalia, dorsal view; 500, female terminalia, ventral view; 501, appendage on aedeagus. *Sweltsa lamba* (Needham and Claassen): 502, male terminalia, dorsal view; 503, male terminalia, lateral view; 504, female terminalia, ventral view; 505, appendage on aedeagus. *Alloperla pilosa* Needham and Claassen: 506, male terminalia, dorsal view; 507, male terminalia, lateral view.

Co. MONTANA: Carbon Co.; Cascade Co.; Flathead Co.; Gallatin Co.; Glacier Co.; Granite Co.; Judith Basin Co.; Lake Co.; Lewis and Clark Co.; Lincoln Co.; Missoula Co.; Ravalli Co.; Sweet Grass Co. OREGON: Baker Co. NEW MEXICO: Taos Co. SOUTH DAKOTA: Lawrence Co. UTAH: Cache Co.; Salt Lake Co.; Sevier Co.; Summit Co.; Utah Co.; Wasatch Co. WYOMING: Albany Co.; Park Co.

Discussion. — This species is common in creeks and small rivers. The adults emerge from April through October.

Sweltsa coloradensis (Banks) (figs. 521-523, 553)

Chloroperla coloradensis Banks, 1898, 25: 199.
Alloperla coloradensis, Needham and Claassen, 1925, 2: 113, male and female; figs. 4-5, p. 335, male and female genitalia.
Alloperla coloradensis, Claassen, 1931, 3: 60, nymph; figs. 83-88, p. 137, nymphal mouthparts.
Alloperla (*Sweltsa*) *coloradensis,* Ricker, 1943, 12: 135.
Sweltsa coloradensis, Illies, 1966, 82: 451.

Type locality. — Colorado.

Geographic range. — Coast, Cascade, Rocky and Sierra Nevada Mts.

Distribution in Rocky Mts. — (Canadian, Northern, Central and Southern Rockies): ALBERTA: Banff N. P.; Waterton Lakes N. P. BRITISH COLUMBIA: Kaslo; Mile 756 Alaska Hwy.; Quesnel; Wells Gray Park. ARIZONA: Apache Co.; Cochise Co.; Coconino Co.; Gila Co.; Graham Co.; Pima Co. COLORADO: Boulder Co.; Chaffee Co.; Delta Co.; Eagle Co.; El Paso Co.; Gilpin Co.; Grand Co.; Gunnison Co.; Hinsdale Co.; Lake Co.; La Plata Co.; Larimer Co.; Routt Co.; Summit Co. IDAHO: Adams Co.; Bannock Co.; Bear Lake Co.; Blaine Co.; Bonner Co.; Bonneville Co.; Caribou Co.; Custer Co.; Elmore Co.; Franklin Co.; Fremont Co.; Idaho Co.; Lemhi Co.; Shoshone Co.; Teton Co.; Twin Falls Co.; Valley Co. MONTANA: Beaverhead Co.; Carbon Co.; Cascade Co.; Flathead Co.; Gallatin Co.; Glacier Co.; Golden Valley Co.; Granite Co.; Lake Co.; Lewis and Clark Co.; Lincoln Co.; Meagher Co.; Missoula Co.; Park Co.; Powell Co.; Ravalli Co.; Silver Bow Co.; Stillwater Co.; Sweet Grass Co.; Wheatland Co.; NEVADA: Elko Co.; Lander Co.; White Pine Co. NEW MEXICO: Catron Co.; Rio Arriba Co.; San Miguel Co.; Taos Co. OREGON: Grant Co. SOUTH DAKOTA: Custer Co.; Lawrence Co. UTAH: Cache Co.; Davis Co.; Duchesne Co.; Iron Co.; Salt Lake Co.; Summit Co.; Tooele Co.; Utah Co.; Wasatch Co.; Weber Co. WYOMING: Albany Co.; Carbon Co.; Johnson Co.; Lincoln Co.; Park Co.; Platte Co.; Teton Co.

Discussion. — This species is common in creeks and small rivers throughout its range. The adults emerge from April through August.

Sweltsa fidelis (Banks) (figs. 56, 524-526)

Alloperla fidelis Banks, 1920, 64: 323, female.
Alloperla fidelis, Needham and Claassen, 1925, 2: 119, male and female; figs. 8-10, p. 331, male and female genitalia.
Alloperla (Sweltsa) fidelis, Ricker, 1943, 12: 137.
Sweltsa fidelis, Illies, 1966, 82: 452.

Type locality. — Great Alpine Creek, Tahoe, California.

Geographic range. — Coast, Cascade, Rocky and Sierra Nevada Mts.

Distribution in Rocky Mts. — (Canadian, Northern and Central Rockies): ALBERTA: Banff N. P.; Waterton Lakes N. P. BRITISH COLUMBIA: Ainsworth; Bowron Lake Park; Dawson Creek; Glacier N. P.; Kamloops; Kaslo; Kootenai N. P.; Mt. Revelstoke N. P.; Oliver; Prince George; Selkirk Range; Slocan City; Summit Lake; Yoho N. P. COLORADO: Grand Co.; Larimer Co. IDAHO: Bannock Co.; Blaine Co.; Boise Co.; Bonner Co.; Butte Co.; Fremont Co.; Idaho Co.; Latah Co.; Lemhi Co. MONTANA: Beaverhead Co.; Broadwater Co.; Carbon Co.; Cascade Co.; Flathead Co.; Gallatin Co.; Glacier Co.; Granite Co.; Judith Basin Co.; Lake Co.; Lewis and Clark Co.; Lincoln Co.; Meagher Co.; Missoula Co.; Park Co.; Powell Co.; Ravalli Co.; Sweet Grass Co. OREGON: Baker Co. UTAH: Cache Co. WYOMING: Albany Co.; Carbon Co.; Park Co.; Sublette Co.

Discussion. — This species is abundant in creeks and rivers in the Pacific Northwest. The adults emerge from May to September.

Sweltsa gaufini Baumann (figs. 499-501, 547)

Sweltsa gaufini Baumann, 1973, 33: 102, male and female; figs. 1, 3-5, p. 94, male and female genitalia; figs. 13I-13K, p. 103, egg.

Type locality. — Ricks Spring, Logan Canyon, Utah.

Geographic range. — Utah and Idaho.

Distribution in Rocky Mts. — (Central Rockies): IDAHO: Bear Lake Co. UTAH: Cache Co.

Discussion. — This species has been collected from several localities in the vicinity of Bear Lake.

Sweltsa lamba (Needham and Claassen) (figs. 502-505)

Alloperla lamba Needham and Claassen, 1925, 2: 115, male and female; figs. 8-9, p. 535, male and female genitalia.
Alloperla lambda, Claassen, 1940, 232: 186.
Sweltsa lamba, Illies, 1966, 82: 452.

Type locality. — Fern Lake, Estes Park, Colorado.

Geographic range. — Coast, Cascade and Rocky Mts.

Distribution in Rocky Mts. — (Northern, Central and Southern Rockies): COLORADO: Boulder Co.; Clear Creek Co.; Custer Co.; Delta Co.; Eagle Co.; Grand Co.; Larimer Co.; Routt Co.; San Juan Co.; Summit Co. IDAHO: Blaine Co.; Bonneville Co.; Cassia Co.; Custer Co.; Franklin Co.; Fremont Co.; Minidoka Co.; Teton Co. MONTANA: Flathead Co.; Gallatin Co.; Glacier Co.; Lewis and Clark Co.; Lincoln Co.; Missoula Co.; Ravalli Co. NEW MEXICO: San Miguel Co.; Taos Co. OREGON: Baker Co.; Grant Co. UTAH: Cache Co.; Davis Co.; Iron Co.; Salt Lake Co.; San Juan Co.; Summit Co.; Wasatch Co.; Washington Co.; Weber Co. WYOMING: Albany Co.; Carbon Co.; Lincoln Co.; Park Co.; Sublette Co.

Discussion. — This species is most common in springs and streams near springs. The adults emerge from June to October.

Sweltsa revelstoka (Jewett) (figs. 515-517)

Alloperla (Sweltsa) revelstoka Jewett, 1955, 13: 152, male and female.
Alloperla fidelis, Frison, 1942b, 22: 346; fig. 126, p. 346, male and female genitalia.
Alloperla (Sweltsa) revelstoki Jewett, 1959, 3: 86.
Sweltsa revelstoki, Illies, 1966, 82: 456.

Type locality. — Mt. Revelstoke N. P., British Columbia.

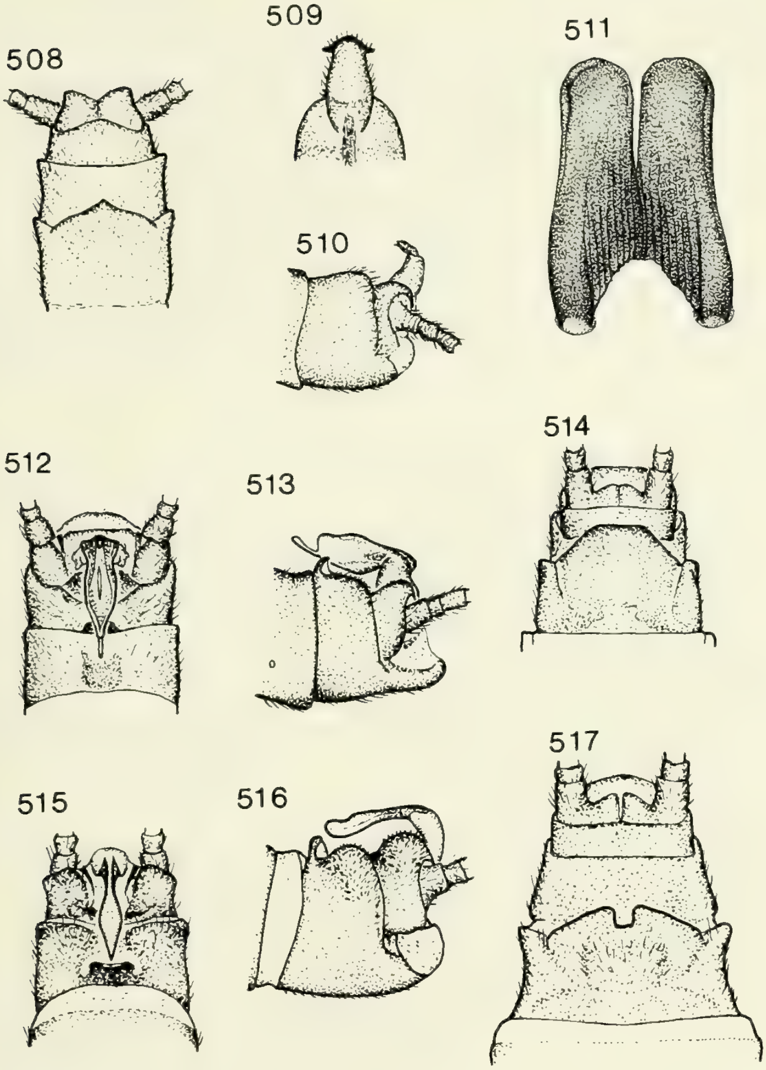
Geographic range. — Coast, Rocky and Cascade Mts.

Distribution in Rocky Mts. — (Canadian and Northern Rockies): ALBERTA: Banff N. P. BRITISH COLUMBIA: Glacier N. P.; Kamloops; Kootenai N. P.; Mt. Revelstoke N. P.; Yoho N. P. MONTANA: Cascade Co.; Flathead Co.; Gallatin Co.; Glacier Co.; Granite Co.; Lake Co. WYOMING: Park Co.

Discussion. — This species is common in small torrential streams and has been collected from very cold lakes at high elevations. The adults emerge in July and August.

Genus TRIZNAKA Ricker 1952

Three species comprise the genus *Triznaka* in the Rocky Mountain area. The epiproct is short, lying in a slight depression and is fused to the tenth tergum (fig. 527). There is a median dark line present inside the U-mark of the meso- and metanota of the adults (fig. 555). The adults of *T. signata* and *T. pintada* are very distinctive and can be recognized in the field by their black head patch and dark median pronotal stripe.



FIGURES 508-517. — *Alloperla medveda* Ricker: 508, female terminalia, ventral view; 509, epiproct, dorsal view; 510, male terminalia, lateral view. *Sweltsa albertensis* (Needham and Claassen): 511, appendage on aedeagus; 512, male terminalia, dorsal view; 513, male terminalia, lateral view; 514, female terminalia, ventral view. *Sweltsa revelstoka* (Jewett): 515, male terminalia, dorsal view; 516, male terminalia, lateral view; 517, female terminalia, ventral view.

Key to the Species of Triznaka

Males

1. Head unmarked except for ocellar rings; pronotum with dusky lateral margins; lobe absent from seventh sternum .... *diversa*
   Head and pronotum conspicuously marked black on yellow (fig. 555); small median lobe on seventh sternum 2
2. Anterior black mark on head as long as wide, often extending posteriorly to median ocellus; median pronotal stripe broad, little produced laterally on posterior margin; little or no pigmentation on pronotal rugosities (fig. 533) .... *signata*
   Anterior mark on head twice as wide as long, not extending to median ocellus; median pronotal stripe narrow, much produced laterally at anterior and posterior margins; heavy pigmentation on pronotal rugosities (fig. 534) .... *pintada*

Females

1. Head unmarked except for ocellar rings, pronotum with dusky lateral margins; subgenital plate tapers to rounded tip (fig. 529) .... *diversa*
   Head and pronotum conspicuously marked black on yellow (fig. 555); subgenital plate broadly rounded, somewhat truncate or slightly emarginate 2
2. Anterior black mark on head as long as wide, often extending posteriorly to median ocellus; median pronotal stripe broad, little produced laterally on posterior margin (fig. 533); subgenital plate broadly rounded (fig. 532) .... *signata*
   Anterior black mark on head twice as wide as long, not extending to median ocellus; median pronotal stripe narrow, greatly produced laterally at anterior and posterior margins (fig. 534); subgenital plate slightly emarginate (fig. 535) .... *pintada*

Triznaka diversa (Frison) (figs. 527-529)

Alloperla diversa Frison, 1935, 61: 333, male and female; pl. 12, figs. 16, 20, pl. 13, fig. 31, male genitalia; pl. 14, fig. 40, female genitalia.
Alloperla nimbilis Hoppe, 1938, 4: 155.
Alloperla (Triznaka) diversa, Jewett, 1959, 3: 36.
Triznaka diversa, Illies, 1966, 82: 457.

Type locality. — East Fork, Hood River, Parksdale, Oregon.

Geographic range. — Coast, Cascade, Rocky and Sierra Nevada Mts.

Distribution in Rocky Mts. — (Canadian, Northern, Central and Southern Rockies): ALBERTA: Banff N. P. BRITISH COLUMBIA: Glacier N. P.; Revelstoke N. P.; Summit Lake. COLORADO: Boulder Co.; Clear Creek Co.; Grand Co.; Gunnison Co.; Larimer Co.; Montezuma Co.; Pitkin Co.; Routt Co.; Summit Co. IDAHO: Adams Co.; Blaine Co.; Bonneville Co.; Camas Co.; Custer Co.; Franklin Co.; Fremont Co.; Idaho Co.; Lemhi Co.; Teton Co.; Valley Co. MONTANA:

Carbon Co.; Granite Co.; Lake Co.; Lincoln Co.; Meagher Co.; Missoula Co.; Park Co.; Powell Co.; Ravalli Co.; Sweet Grass Co. NEW MEXICO: San Miguel Co.; Santa Fe Co.; Taos Co. UTAH: Cache Co.; Salt Lake Co.; Sevier Co.; Summit Co.; Utah Co.; Wasatch Co. WASHINGTON: Pend Oreille Co. WYOMING: Park Co.; Teton Co.

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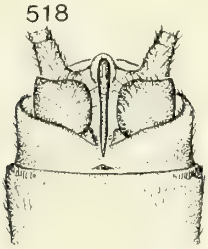

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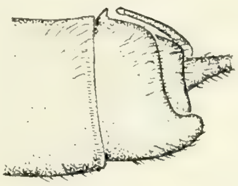

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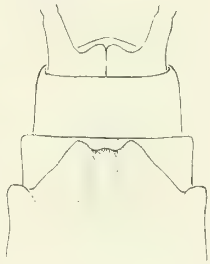

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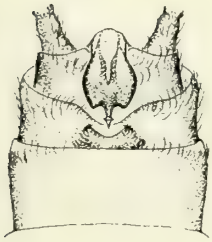

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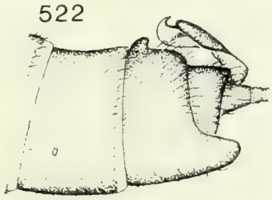

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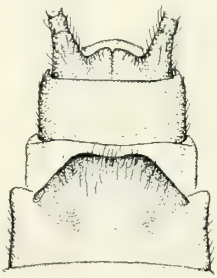

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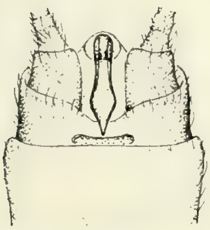

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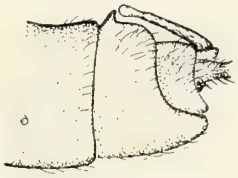

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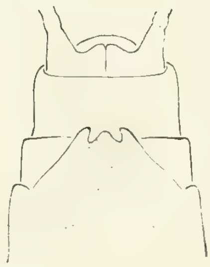


FIGURES 518-526. — *Sweltsa borealis* (Banks): 518, male terminalia, dorsal view; 519, male terminalia, lateral view; 520, female terminalia, ventral view. *Sweltsa coloradensis* (Banks): 521, male terminalia, dorsal view; 522, male terminalia, lateral view; 523, female terminalia, ventral view. *Sweltsa fidelis* (Banks): 524, male terminalia, dorsal view; 525, male terminalia, lateral view; 526, female terminalia, ventral view.

Discussion. — This species is common in creeks and small rivers. The adults emerge from May to July.

Triznaka pintada (Ricker) (figs. 534, 535)

Alloperla pintada Ricker, 1952, 18: 186, male and female; figs. 147-150, p. 188, male and female genitalia.
Alloperla (*Triznaka*) *pintada,* Jewett, 1959, 3: 86.
Triznaka pintada, Illies, 1966, 82: 457.

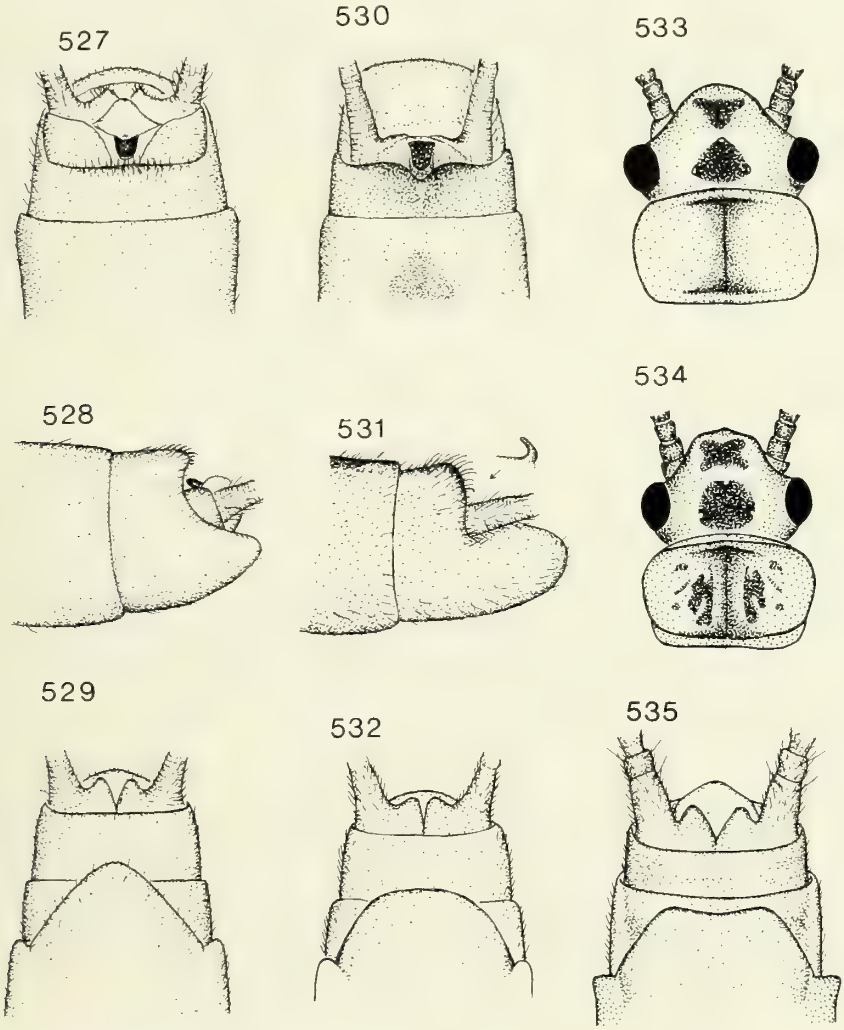
Type locality. — Edloe, Colorado.
Geographic range. — Coast, Cascade, Rocky and Sierra Nevada Mts.
Distribution in Rocky Mts. — (Southern and Central Rockies): ARIZONA: Apache Co. COLORADO: Boulder Co.; Chaffee Co.; Eagle Co.; El Paso Co.; Grand Co.; Gunnison Co.; Huerfano Co.; Lake Co.; La Plata Co.; Routt Co.; Teller Co. IDAHO: Cassia Co.; Custer Co.; Lemhi Co.; Teton Co. NEVADA: Clark Co.; Elko Co. NEW MEXICO: Lincoln Co.; Taos Co. UTAH: San Juan Co.; Summit Co. WYOMING: Albany Co.; Platte Co.
Discussion. — This species occurs in creeks and rivers. The adults emerge in May through August.

Triznaka signata (Banks) (figs. 44, 530-533)

Chloroperla signata Banks, 1895, 22: 314.
Alloperla signata Banks, 1907a, p. 13.
Alloperla signata, Needham and Claassen, 1925, 2: 121, male and female; figs. 5-6, p. 330, male and female genitalia.
Alloperla (*Triznaka*) *signata,* Ricker, 1952, 18: 186.
Triznaka signata, Illies, 1966, 82: 457.

Type locality. — Pullman, Washington.
Geographic range. — Coast, Cascade and Rocky Mts.
Distribution in Rocky Mts. — (Canadian, Northern, Central and Southern Rockies): BRITISH COLUMBIA: Prince George; Quesnel. COLORADO: Boulder Co.; Eagle Co.; Garfield Co.; Grand Co.; Gunnison Co.; Hinsdale Co.; La Plata Co.; Larimer Co.; Moffat Co.; Montezuma Co.; Montrose Co.; Rio Blanco Co.; Rio Grande Co.; Routt Co.; Saguache Co.; Summit Co.; Teller Co. IDAHO: Adams Co.; Bear Lake Co.; Bonneville Co.; Custer Co.; Franklin Co.; Fremont Co.; Lemhi Co.; Teton Co.; Valley Co. MONTANA: Big Horn Co.; Broadwater Co.; Carbon Co.; Cascade Co.; Flathead Co.; Gallatin Co.; Glacier Co.; Golden Valley Co.; Granite Co.; Lake Co.; Lewis and Clark Co.; Lincoln Co.; Meagher Co.; Missoula Co.; Park Co.; Pondera Co.; Ravalli Co.; Silver Bow Co.; Stillwater Co.; Sweet Grass Co.; Wheatland Co. NEW MEXICO: Colfax Co.; Rio Arriba Co.; San Miguel Co.; Santa Fe Co.;

Taos Co. SOUTH DAKOTA: Custer Co. UTAH: Cache Co.; Duchesne Co.; Sevier Co.; Summit Co.; Uintah Co.; Utah Co.; Wasatch Co. WYOMING: Albany Co.; Carbon Co.; Fremont Co.; Grand Co.; Johnson Co.; Lincoln Co.; Sheridan Co.; Sublette Co.; Teton Co.; Uinta Co.



FIGURES 527-535. — *Triznaka diversa* (Frison): 527, male terminalia, dorsal view; 528, male terminalia, lateral view; 529, female terminalia, ventral view. *Triznaka signata* (Banks): 530, male terminalia, dorsal view; 531, male terminalia, lateral view; 532, female terminalia, ventral view; 533, head and pronotum of adult. *Triznaka pintada* (Ricker): 534, head and pronotum of adult; 535, female terminalia, ventral view.

Discussion. — This species is common in creeks and rivers. The adults emerge from May to August.

Subfamily Paraperlinae

Genus KATHROPERLA Banks 1920

The monotypic genus *Kathroperla* is easily distinguished from all other chloroperlids by the very elongated head in both the adult and nymph (fig. 548). The adult head is yellow with a dark spot over the ocellar triangle. The pronotum is dark brown with a median yellow stripe and a yellow mark on the lateral margins. This large chloroperlid is twenty to twenty-five mm. long.

Kathroperla perdita Banks (figs. 45, 542, 543, 548)

Kathroperla perdita Banks, 1920, 64: 315.
Kathroperla perdita, Needham and Claassen, 1925, 2: 132, male and female; figs. 7-8, p. 337, male and female genitalia.
Kathroperla perdita, Neave, 1934, 66: 2, nymph.
Kathroperla perdita, Ricker, 1943, 12: 131; fig. 126, p. 140, nymph.

Type locality. — Kaslo, British Columbia.

Geographic range. — Coast, Cascade, Rocky and Sierra Nevada Mts.

Distribution in Rocky Mts. — (Canadian and Northern Rockies): ALBERTA: Banff N. P. BRITISH COLUMBIA: Campbell Creek, Purcell Range; Kaslo; Summit Lake. IDAHO: Bonner Co.; Lemhi Co.; Shoshone Co. MONTANA: Cascade Co.; Flathead Co.; Gallatin Co.; Glacier Co.; Granite Co.; Lake Co.; Lewis and Clark Co.; Missoula Co.; Powell Co.; Ravalli Co. OREGON: Union Co.

Discussion. — This species is found in creeks and small rivers. The adults emerge from May to July.

Genus PARAPERLA Banks 1906

Paraperla contains two species in the Rockies. The head is long and the eyes are situated more anteriorly than in all other genera except *Kathroperla* (fig. 57). Both adults and mature nymphs are darkly colored and range in size from eleven to seventeen mm. The two species are similar and often confused but may be separated after close examination.

FIGURES 536-545. — *Utaperla sopladora* Ricker: 536, male terminalia, dorsal view; 537, male terminalia, lateral view; 538, female terminalia, ventral view. *Paraperla frontalis* (Banks): 539, male terminalia, dorsal view; 540, male terminalia, lateral view; 541, female terminalia, ventral view. *Kathroperla perdita* Banks: 542, female terminalia, ventral view; 543, male terminalia, dorsal view. *Neaviperla forcipata* (Neave): 544, male terminalia, lateral view; 545, male terminalia, dorsal view.

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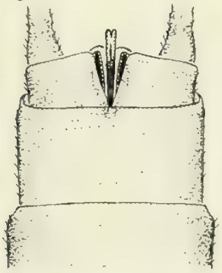

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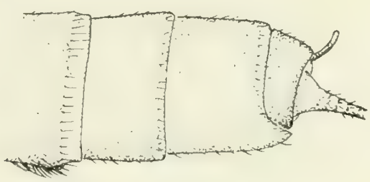

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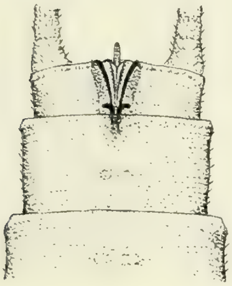

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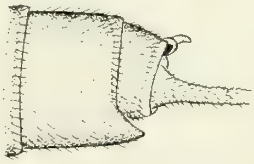

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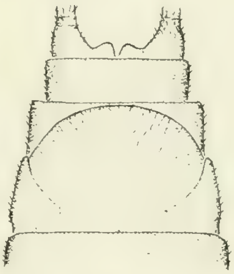

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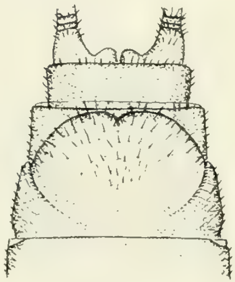

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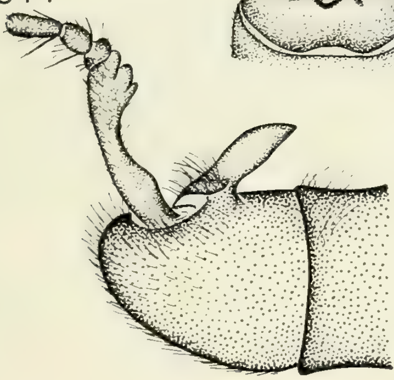

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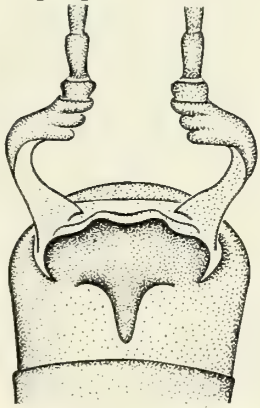


Key to the Species of Paraperla

Males

1. Lateral stylets absent; hind corners of head rounded; epiproct more sclerotized and straight or nearly so at tip; median pronotal stripe broad (fig. 551) .... *wilsoni*
   Lateral stylets present (fig. 539); hind corners of head angular; epiproct more membranous and somewhat curved at tip (fig. 540); median pronotal stripe narrow (fig. 552) .... *frontalis*

Females

1. Subgenital plate shallowly and roundly notched, or scarcely notched at all; median pronotal stripe broad (fig. 551) .... *wilsoni*
   Subgenital plate notched and forming sharp angle medially (fig. 541); median pronotal stripe narrow (fig. 552) .... *frontalis*

Paraperla frontalis (Banks) (figs. 46, 539-541, 550, 552)

Perlinella frontalis Banks, 1902, 34: 123.
Paraperla frontalis, Needham and Claassen, 1925, 2: 130, male and female; figs. 4-6, p. 337, male and female genitalia.
Paraperla frontalis, Claassen, 1931, 3: 65, nymph; fig. 193, p. 161, nymph.

Type locality. — Beulah, New Mexico.

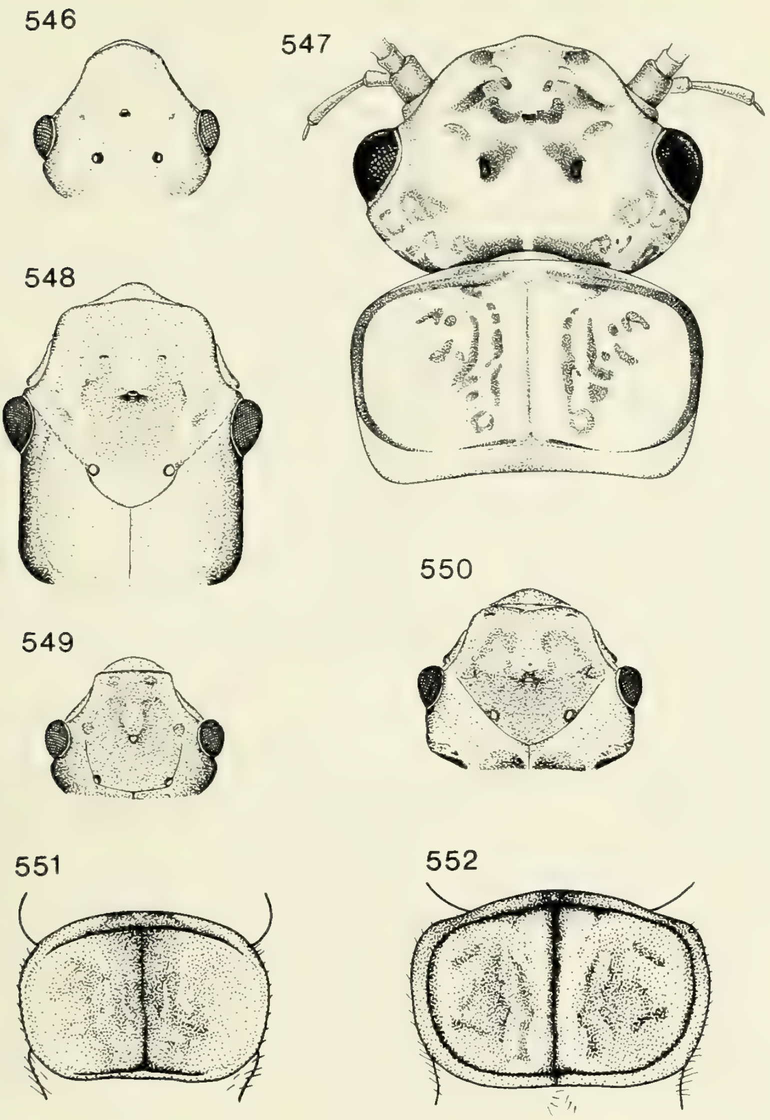
Geographic range. — Coast, Cascade, Rocky and Sierra Nevada Mts.

Distribution in Rocky Mts. — (Canadian, Northern, Southern and Central Rockies): ALBERTA: Banff N. P.; Waterton Lakes N. P. BRITISH COLUMBIA: Campbell Creek; Fernie; Summit Lake. COLORADO: Boulder Co.; Chaffee Co.; Clear Creek Co.; Gunnison Co.; Hinsdale Co.; Mineral Co.; Routt Co. IDAHO: Bear Lake Co.; Bonner Co.; Custer Co.; Franklin Co.; Fremont Co.; Idaho Co.; Lemhi Co.; Shoshone Co. MONTANA: Flathead Co.; Gallatin Co.; Glacier Co.; Granite Co.; Judith Basin Co.; Lake Co.; Lewis and Clark Co.; Missoula Co.; Ravalli Co.; Sweet Grass Co. NEW MEXICO: San Miguel Co.; Taos Co. OREGON: Baker Co.; Union Co. SOUTH DAKOTA: Lawrence Co. UTAH: Cache Co.; Duchesne Co.; Salt Lake Co.; Summit Co.; Utah Co.; Wasatch Co. WYOMING: Sublette Co.; Teton Co.

Discussion. — This species is found in creeks, rivers and cold lakes. The adults emerge from April to early August.

Paraperla wilsoni Ricker (fig. 551)

Paraperla wilsoni Ricker, 1965, 22: 496, male and female; figs. 46-47, p. 497, male and female genitalia.
Paraperla wilsoni, Zwick, 1973, 94: 281.



FIGURES 546-552. — 546, *Alloperla severa* Hagen, head; 547, *Sweltsa gaufini* Baumann, head and pronotum; 548, *Kathroperla perdita* Banks, head; 549, *Utaperla sopladora* Ricker, head; 550, *Paraperla frontalis* (Banks), head; 551, *Paraperla wilsoni* Ricker, pronotum; 552, *Paraperla frontalis* (Banks), pronotum.

Type locality. — Chilliwack River, Vedder Crossing, British Columbia.

Geographic range. — Coast, Cascade and Rocky Mts.

Distribution in Rocky Mts. — (Canadian and Northern Rockies): ALBERTA: Banff N. P. BRITISH COLUMBIA: Glacier; Mt. Revelstoke; Summit Lake. IDAHO: Custer Co.; Valley Co. MONTANA: Flathead Co.; Glacier Co.; Granite Co.; Judith Basin Co.; Lake Co.; Missoula Co. OREGON: Wallowa Co.

Discussion. — This species is found in creeks and small rivers. The adults emerge from March through August.

Genus UTAPERLA Ricker 1952

Only two nearctic species are known in this genus, one from Quebec and the northeastern United States, and our western species, *Utaperla sopladora.* The adults are black with long cerci and can easily be separated from all other summer emerging stoneflies. The head is only slightly elongate when compared to the other members of the Paraperlinae. It is the smallest member of the subfamily, seldom exceeding ten mm. in length. The nymph was only recently described (Surdick and Cather, 1975) and can be distinguished by its head shape and occipital suture (fig. 478).

Utaperla sopladora Ricker (figs. 47, 478, 536-538, 549)

Utaperla sopladora Ricker, 1952, 18: 175, male and female; figs. 125-130, p. 175, male and female genitalia and wings.

Utaperla sopladora, Nelson and Hanson, 1969, 45: 26, redescription of male and female.

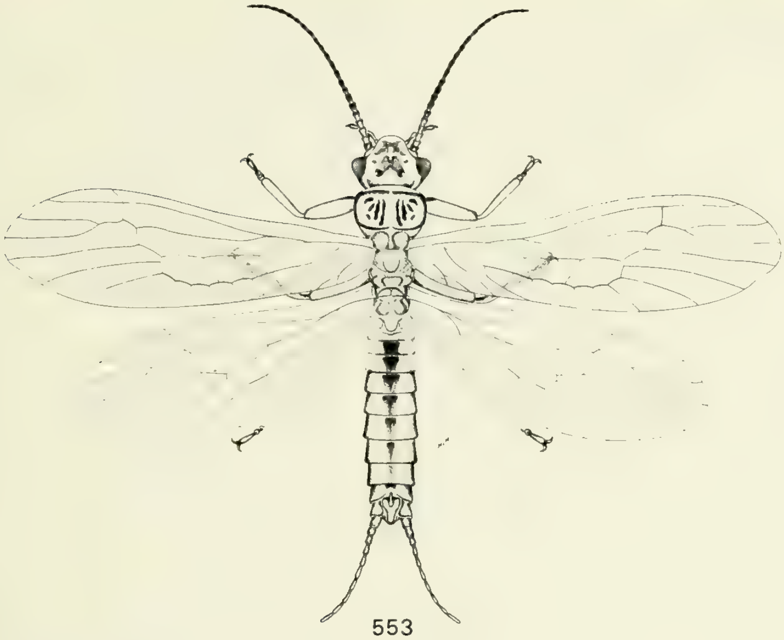
Utaperla sopladora, Surdick and Cather, 1975, 86: 102, nymph; figs. 1-8, pp. 104-106, nymph and nymphal mouthparts.

Type locality. — Puffers Lake, Utah.

Geographic range. — Coast, Cascade and Rocky Mts.

Distribution in Rocky Mts. — (Canadian, Northern, Central and Southern Rockies): ALBERTA: Banff N. P. BRITISH COLUMBIA: Summit Lake. IDAHO: Blaine Co.; Lemhi Co.; Twin Falls Co. MONTANA: Flathead Co.; Gallatin Co.; Glacier Co.; Granite Co.; Mineral Co.; Lake Co.; Lewis and Clark Co.; Ravalli Co. NEVADA: Elko Co. UTAH: Beaver Co.; Summit Co.; Wasatch Co. WYOMING: Sublette Co.

Discussion. — This species is uncommon and found in creeks and small rivers. The adults emerge from May to July.



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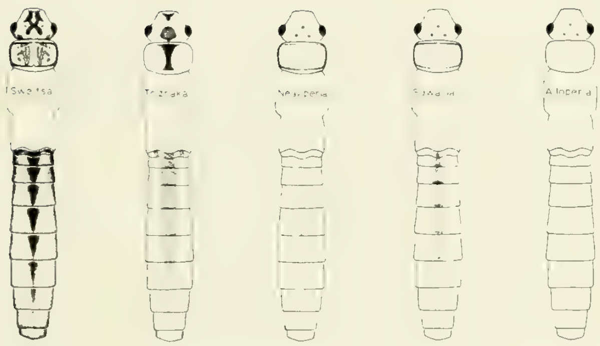

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FIGURES 553-558. — 553, *Sweltsa coloradensis* (Banks), adult male, habitus. 554-558, adult color patterns: 554, *Sweltsa* sp.; 555, *Triznaka* sp.; 556, *Neaviperla* sp.; 557, *Suwallia* sp.; 558, *Alloperla* sp.

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Index of genera and species of Rocky Mountain Plecoptera; synonyms and misspellings included; **boldface** numbers indicate valid taxa.

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